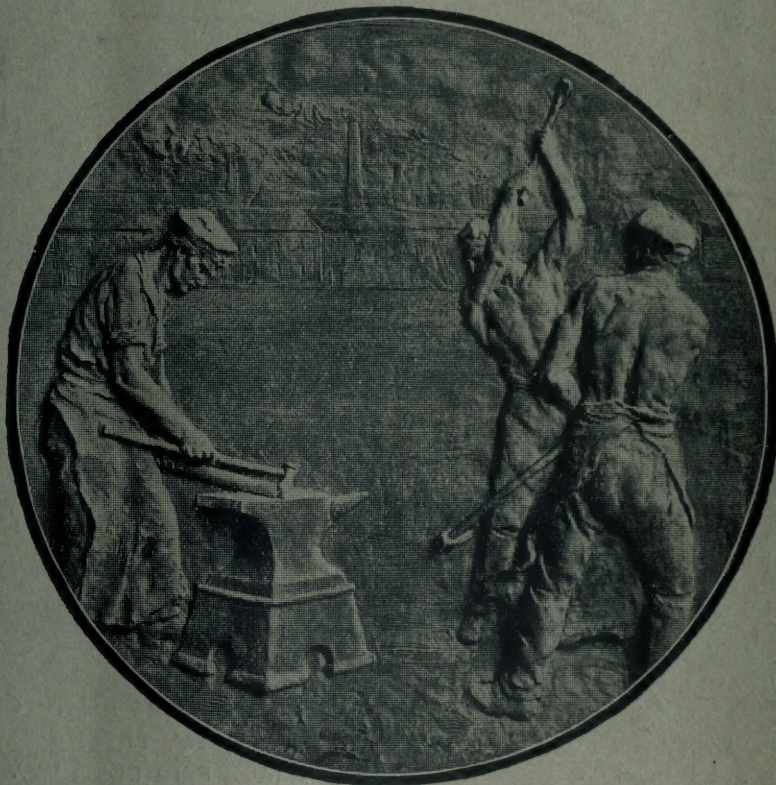
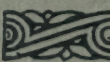


PAGE'S WEEKLY



ENGINEERING · ELECTRICITY
SHIPBUILDING  MINING
IRON & STEEL INDUSTRIES

EDITORIAL &
PUBLISHING OFFICES, CLUN HOUSE, SURREY STREET, STRAND, LONDON, W.C.

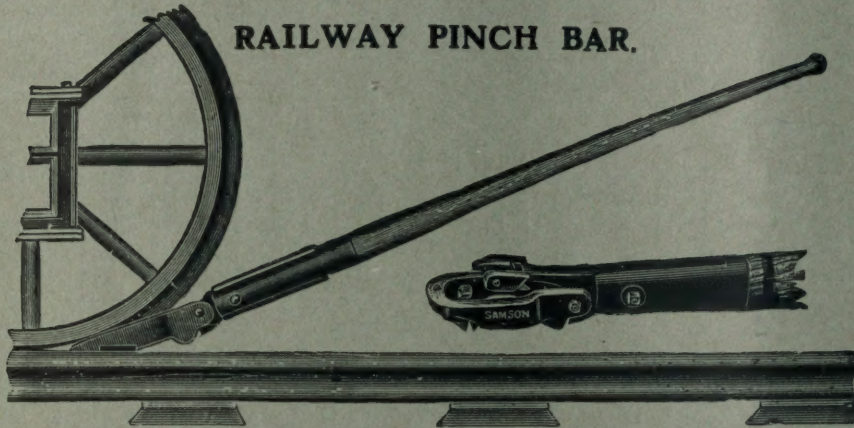
FRANCE, Paris : 22, Rue de la Paix.
GERMANY, Berlin : 13, Unter den Linden.
RUSSIA, St. Petersburg : 14, Nevsky Prospekt.
ITALY, Rome : 307 Corso.
AUSTRIA, Vienna : Kärntnerstrasse, nr. 30

INDIA, Calcutta : Thacker, Spink & Co.
Bombay : Thacker & Co., Ltd.
SOUTH AFRICA, Cape Town : Gordon & Gotch.
JAPAN, Yokohama : Kelly & Walsh, Ltd.
NEW ZEALAND : Gordon & Gotch, Ltd.

CANADA : Montreal News Company.
UNITED STATES, New York : International News Co.
Chicago : Subscription News Co.
AUSTRALIA, Melbourne : Gordon & Gotch.
Straits Settlements, Singapore : Kelly & Walsh, Ltd.

The "SAMSON."

RAILWAY PINCH BAR.



A Few of the Users of the "Samson" Pinch Bars:—

Cambrian Railways.
Cork, Bandon & South Coast Railway Co.
Donegal Railway Co.
Great Northern Railway Co.
Great Southern and Western Railway Co.
London and North Western Railway Co.
Midland Railway Co.
Midland Railway Co., N.C. Committee.
Bolechow Vaughan & Co.'s Collieries.
Grassmoor Collieries.
Garforth Collieries.
Henry Briggs, Son & Co., Ltd.
Hoyland Silkstone Collieries.
Houghton Main Collieries.
J. & G. Wells' Eckington Collieries.
Micklefield Coal and Lime Co.
Mitchell Main Collieries.
Shireoaks Collieries.
Sheepbridge Co., Iron and Steel Works
Staveley Iron and Coal Co.

The "Samson"

Pinch Bar

Is used as a great labour-saving tool where wagons or locomotives require moving short distances.

OUR OFFER:—

SPECIMEN BAR SENT ON
SEVEN DAYS' FREE TRIAL
CARRIAGE PAID BOTH WAYS.

SAMSON & CO.,

Garforth, near LEEDS.

PAGE'S WEEKLY

Miscellaneous

Mr. G. H. HUGHES, M.I.Mech.E.,

Consulting and Organising Engineer for Water
Works and Industrial Undertakings,

97, QUEEN VICTORIA ST., LONDON, E.C.

Telephone No.: 5754 Bank.

Write for particulars.

HIGH SPEED INDICATORS.

Hannan & Buchanan,
75, Robertson Street, Glasgow.
ENGINE COUNTERS.
BOURDON GAUGES.
On Admiralty List.
Engineering Instrument Makers




RIVETS, BOLTS, & SCREWS

Of all Descriptions and for all Purposes.

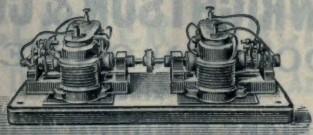
SEND FOR CATALOGUE.

T. D. ROBINSON & CO., Ltd.,
DERBY.

Alternating to Continuous Motor Generators.

DYNAMOS

ALTERNATORS



THE CRYPTO ELECTRICAL CO.,

Telephone:

3, Tyers Gateway,

12830

CENTRAL.

BERMONDSEY ST., S.E.

THE ACME WATER STORAGE and CONSTRUCTION CO., Ltd.,

Patented March 9th, 1897.

U.S.A.

Water stored where most convenient under
pressure and automatically distributed.

For Town and Village Supplies, Suburban Establish-
ments, High Buildings, Factory Sprinklers, etc.
Descriptive Circular sent on request.

ERIC S. A. SMITH, Water Supply Engineer,
BRIDLINGTON.

Licenses, Sole Agent, and Manufacturer for the United Kingdom
and Colonies.

PAGE & ROWLINGSON, Chartered Patent Agents.

Mr. PAGE, who is a Whitworth Exhibitioner and an Associate Member
of the Institute of Civil Engineers, has had a large experience as a Practical
Mechanical Engineer, and is specially qualified to deal with the most
intricate mechanical problems successfully. Write for Handbook of

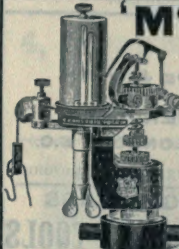
Information Free.

28, NEW BRIDGE STREET, LONDON, E.C.,
And 14, St. Ann's Square, Manchester.

**M'INNES-DOBBIE'
INDICATORS.**

In Two types: External and
Enclosed Pressure Springs.
Each made in several forms and sizes
to suit all speeds and pressures.
Special Indicators for Gas, Winding,
and Ammonia Engines, and for
Motor-Cars.

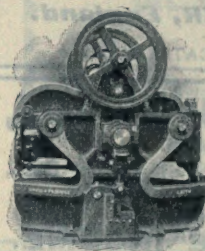
DOBBIE McINNES, LIMITED,
Adopted by the British, French,
and Japanese Admiralties. 45, BOTHWELL ST., GLASGOW.



WAYGOOD LIFTS

APPLY FOR CATALOGUE.

FALMOUTH ROAD, LONDON, S.E.



**PUNCHING &
SHEARING Machines.**
STEAM HAMMERS.

Shipbuilders'
MACHINE TOOLS.

DAVIS & PRIMROSE,
Leith Ironworks, EDINBURGH.

BABCOCK & WILCOX, Ltd.

PATENT WATER-TUBE BOILERS.

These Boilers are in use throughout the world to the extent of 4,700,000 h.p.
generating steam for all purposes, and fired with all kinds of fuel.

See our Advertisement appearing July 7th, page 37.

HEAD OFFICES—Oriental House, Farringdon Street, LONDON, E.C.

WORKS—Renfrew, SCOTLAND.

GRAHAM, MORTON & CO. LTD.

Head Office and Works, **LEEDS.**

Makers and Erectors of all Classes of
CONVEYING PLANTS, COAL HANDLING PLANTS,
AERIAL ROPEWAYS, &c., &c.

ENGINEERING PHOTOGRAPHY

Price List on application to—

BOOKER & SULLIVAN,

67 and 69, Chancery Lane,

Telephone: 9252 Central.

LONDON, W.C.

PAGE'S WEEKLY

Miscellaneous



Heating Apparatus BOILERS

Wrot Welded Iron and Cast Iron
Sectional
VERTICAL STEAM BOILERS

Apply for Catalogue.

TRANSPORTERS.

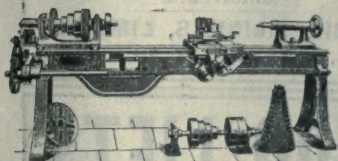
See our Advertisement appearing July 7th.

TEMPERLEY TRANSPORTER CO.,

72, Bishopsgate Street Within, LONDON, E.C.

Tel ephone: 365 London Wall.

Telegrams: "Transumo."



HIGH-CLASS
MACHINE TOOLS

In stock for immediate delivery.

THOS. W. WARD, L^d.

Albion Works,
SHEFFIELD.

STONE BREAKERS,

GRAVEL WASHERS, ETC.

SAMUEL PEGG & SONS, Engineers,
LEICESTER, England.

SEND FOR ILLUSTRATED CATALOGUE.

M. GLOVER & CO., LEEDS,

SAW MILL ENGINEERS.

"IDEAL" GUARDS, BENCHES, SHARPENERS,
FIREWOOD, and LIGHTER PLANTS,

Saving in Wages alone means

A CERTAIN LARGE INCOME.



A NEW GAUGE GLASS,
Samples, Lists, and
Testimonials on application

"S.H.P."

Tested to
350 lb. Steam
Pressure.

For High Pressure
Boilers.

BRETT'S PATENT LIFTER CO., LTD.,
COVENTRY, ENG.

Speciality—

FORGING PLANT.

See our Advertisement appearing July 7th.

SEND FOR LATEST CATALOGUE.



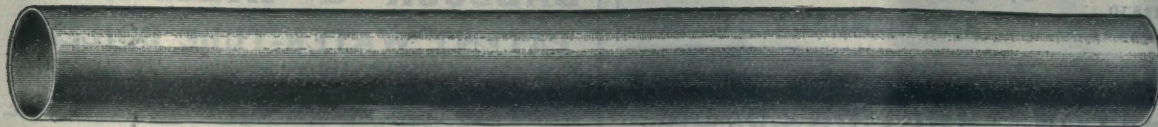
HEAD, WRIGHTSON & CO., LTD.

STOCKTON-ON-TEES,

for all kinds of

Colliery Plant & Mining Machinery.

WELDED AND RIVETED STEEL PIPES.



THOMAS PIGGOTT & CO., LTD., SPRING HILL, BIRMINGHAM.

Send for Catalogue.

SHONE PNEUMATIC EJECTORS

FOR RAISING SEWAGE, SLUDGE, WATER, &c.

Air Compressing Machinery

FOR ALL SERVICES.

HUGHES & LANCASTER

47, VICTORIA STREET, LONDON, S.W.

WALTER SCOTT, LTD.,

LEEDS STEEL
WORKS, LEEDS,
ENGLAND.

MANUFACTURERS OF

Rolled Steel Joists, Channels, etc.

Mild Steel Blooms, Billets, Slabs, Tinbars, Rounds and Flats.

Speciality: TRAMRAILS.

Rochester Card
Bundy Key
Signature
Journey
Speed

RECORDERS.

For further particulars
.. of our ..

see our whole page Ad. on July 7th.

TIME RECORDERS

RECORDERS, LTD., 171, Queen Victoria Street, LONDON, E.C.

PAGE'S WEEKLY

Miscellaneous

"ZECO" Brand. Blue Planished and Glazed Steel Sheets for Lagging and Covering generally.

ZEITZ & Co., 21, Lime St., London, E.C.

HIGH-CLASS NON-CORROSIVE LUBRICATING OILS AND SOLIDIFIED LUBRICANTS.

(Castor, Lard, Olive, Neatsfoot, and Linseed Oils, Tallow, &c.)

RELiance LUBRICATING OIL CO.,
19 & 20, Water Lane, Great Tower Street.
LONDON, E.C.
Also at GLASGOW, HULL, BRISTOL, AND NEWCASTLE-ON-TYNE.

MALLEABLE IRON & STEEL CASTINGS FOR ENGINEERS & TOOL MAKERS
TO MACHINE CLEAN & BRIGHT ALL OVER.
PARKER FOUNDRY CO. DERBY
ON ADMIRALTY LIST.

DESTRUCTORS and CLINKER MACHINERY.

Horsfall Destructor Co., Ltd., Armley, Leeds.

Telegrams: "DESTRUCTOR." Telephone: 2006.
Codes: A.B.C. (5th Edition) and Leibner's.

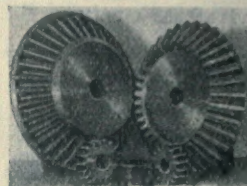
Refuse Destructors.

Write for particulars to:-

HEENAN & FROUDE, LIMITED,

4, Chapel Walks, MANCHESTER.

Works: MANCHESTER and WORCESTER.



Rawhide Gears

A SPECIALITY.

Also all kinds of Metal Gearing.

AD. AHLERS,

Whitley Bay, Newcastle-on-Tyne.

"CAMPBELL"

GAS ENGINES & SUCTION PLANTS, OIL ENGINES & PUMPS.

SOLE MAKERS—

THE CAMPBELL GAS ENGINE CO.

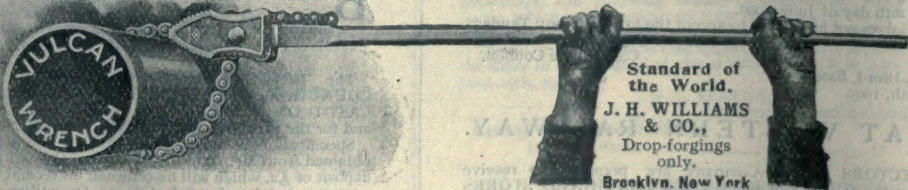
Halifax, England. Limited,

London Office—

114, Tooley Street, S.E.

Glasgow Office—

104, Bath Street,



Standard of the World.

J. H. WILLIAMS & CO.,
Drop-forgings only.

Brooklyn, New York

ALLEN'S IMPERIAL Manganese Steel POINTS & CROSSINGS For ELECTRIC TRACTION.

LAYOUTS Constructed Complete in our Works.

Edgar Allen & Co., Ltd., Imperial Steel Works, Sheffield.

PAGE'S WEEKLY

Contracts

CONTRACTS.

GRAYS THURROCK URBAN DISTRICT COUNCIL.

ELECTRICITY DEPARTMENT.

THE COUNCIL INVITE TENDERS

from Manufacturers for the following Plant :—
STORAGE BATTERY.
FEED PUMP.
SWITCHBOARD EXTENSION.
ECONOMISER EXTENSION (GREENS).

Specifications and particulars can be obtained from the Electrical Engineer, Maidstone Road, Grays.
Sealed Tenders, endorsed "Tender for —," to be addressed to the undersigned on or before Saturday, June 17th.

The Council do not bind themselves to accept the lowest or any Tender.

HATTEN and ASPLIN,
Clerks.

BOROUGH OF DARLINGTON.

SWITCHBOARD EXTENSION AND BOOSTER.

THE DARLINGTON CORPORATION

invite TENDERS for the SUPPLY, DELIVERY, and ERECTION of an EXTENSION to their SWITCHBOARD and a HAND REVERSIBLE BOOSTER, at their Electricity Works.

Copy of specification, general conditions, &c., to be obtained from the Borough Electrical Engineer, Electricity Department, Haughton Road, Darlington, on payment of 4s. 1s., which amount will be returned on receipt of *bona fide* Tender.

Tenders on the prescribed form, in sealed envelopes, and endorsed on the outside "Tender for Switchboard, &c.," must be delivered at my office on or before the 19th day of June, 1905.

HY. G. STEAVENSON,
Town Clerk's Office, Darlington,
May 29th, 1905. Town Clerk.

LFORD URBAN DISTRICT COUNCIL.

DUST DESTRUCTOR.

The above Council invites TENDERS for the erection of a DUST DESTRUCTOR of Six Cells, viz :—

CELLS, FLUES, DUST CHAMBER, and BOILERS.

Full particulars of the Scheme may be obtained on application to Mr. HERBERT SHAW, A.M.Inst.C.E., Engineer and Surveyor to the Council, at the Town Hall, Ilford, Essex, during the usual office hours, on payment of a deposit of 4s 5s., which will be returned on receipt by the Council of a *bona fide* Tender.

Sealed Tenders, endorsed "Tender for Dust Destructor" are to be addressed and sent to the undersigned here on or before noon on Monday, the 26th day of June, 1905.

The Council does not bind itself to accept the lowest or any Tender.

JOHN W. BENTON,
Clerk to the Council.

Town Hall, Ilford, Essex,
June 5th, 1905.

GREAT WESTERN RAILWAY.

The DIRECTORS of this Company are prepared to receive TENDERS for the SUPPLY of the UNDERMENTIONED STORES from July 1st, 1905, to June 30th, 1906.

1. Laminated Springs.
2. Spiral and Volute Springs.
3. Tyres.
4. Straight Axles.
5. Steel Crank Axles and Forgings for Built-up Cranks.
6. Iron Bars.
7. Steel Plates and Sheets.
8. Steel Bars and Blooms.
9. Steel Castings.
10. Iron Forgings.
11. Chain and Special Iron for Chain Manufacture.
12. Tubes and Fittings.
13. Cast-Iron Socket Pipes.
14. Tool Steel.

Specifications and Forms of Tender (upon which alone Tenders will be received) may be obtained on application to the undersigned or to the Stores Superintendent at Swindon.

Tenders, addressed to the undersigned, and marked outside "Tender for Stores," will be received on or before Monday, June 19th.

The Directors do not bind themselves to accept the lowest or any Tender.

Paddington Station, London,
June 3rd, 1905.

G. K. MILLS,
Secretary.

COUNTY BOROUGH of SOUTHAMPTON.

WEIGHBRIDGES.

The CORPORATION of Southampton invite TENDERS for SUPPLYING and FIXING THREE WEIGHBRIDGES at their Depots.

A Specification may be inspected and further particulars obtained upon application to Mr. J. A. CROWTHER, Borough Engineer.

Tenders, endorsed "Tender for Weighbridges," must be left at the Town Clerk's Office before 2 p.m. on the 27th instant.

No pledge is given to accept the lowest or any tender.

By order,
R. R. LINTHORNE,
Town Clerk's Office,
Municipal Offices, Southampton,
June 2nd, 1905. Town Clerk.

CITY OF NOTTINGHAM.

WATER DEPARTMENT.

TENDERS FOR THE SUPPLY OF VALVES AND HYDRANTS
PIPES, LEAD, COAL, TAPS, AND FITTINGS.

The WATER COMMITTEE of the CORPORATION are prepared to receive TENDERS from competent Ironfounders, Brassfounders, Valve Manufacturers, Lead Merchants, and Colliery Proprietors and Coal Merchants for the SUPPLY of the UNDERMENTIONED GOODS for the ensuing Year :—

1. Cast-Iron Double-Faced Sluice Valves and Hydrants.
2. Cast-Iron Main Pipes, Cast-Iron Special Pipes.
3. Lead Piping, Lead Ingots.
4. Gunmetal Taps and Ferrule Fittings.
5. Steam Coal and other Fuel.

Specifications and Drawings, together with Samples, Weights, etc., may be seen and other information obtained at the Office of the Water Engineer, Mr. F. W. DAVIES, St. Peter's Churchside, and Forms of Tender may be obtained at that Office on payment of One Guinea, which sum will be returned on receipt of a *bona fide* Tender.

Tenders, endorsed "Tender for Valves," "Tender for Pipes," "Tender for Lead," "Tender for Taps," or "Tender for Coal," to be delivered to me at the Guildhall, Nottingham, on or before June 24th next. Samples of Coals for testing purposes must be sent in not later than June 15th, or the Tenders will not be considered.

The Committee do not bind themselves to accept the lowest or any Tender.

By order of the Water Committee,
SAMUEL G. JOHNSON,
Guildhall, Nottingham,
May 29th, 1905. Town Clerk.

BRUMBY AND FRODINGHAM WATER SUPPLY.

CONTRACT No. 3.

The BRUMBY AND FRODINGHAM URBAN DISTRICT COUNCIL invite TENDERS for LAYING about 15,000 yards of CAST-IRON WATER-PIPES, ranging from 3in. to 7in. in diameter, and for the SUPPLY and FIXING of VALVES and FITTINGS.

Specification, Schedule of Quantities, and Form of Tender can be obtained from Mr. ALFRED ATKINSON, C.E., of Brigg, on payment of a deposit of £2, which will be returned on receipt of a *bona fide* Tender accompanied by the Schedule of Quantities, with all prices duly filled in.

Sealed Tenders, on the forms supplied, endorsed "Tender for Pipe-laying," must be delivered at my office not later than 10 a.m. on June 19th, 1905.

The Council do not bind themselves to accept the lowest or any Tender.

G. S. SOWTER,
Brigg, May 25th, 1905. Clerk to the Council.

VICTORIAN RAILWAYS.

TENDERS are invited for the MANUFACTURE, SUPPLY, and DELIVERY of STEEL RAILS and FISHPLATES.

Tenders, accompanied by the preliminary deposit of £250, must be lodged in the tender box at the Railway Offices, Melbourne, Victoria, Australia, or at the Office of the AGENT-GENERAL FOR VICTORIA, 142, Queen Victoria Street, London, E.C., before 1 p.m., Monday, the 7th August.

Specifications and Drawings will be available at the Agent-General's Office on the 18th June.

PAGE'S WEEKLY

Contracts

ABERDEEN HARBOUR.—DOCK RAILWAYS.

The Aberdeen Harbour Commissioners are prepared to receive TENDERS for the following PERMANENT-WAY MATERIALS, viz:—

- (1) Steel Rails and Guard Rails.
- (2) Steel fishplates.
- (3) Steel Fishbolts and Rail Clips.

Copies of the specification, conditions of contract, and form of Tender may be obtained from the undersigned on payment of Ten Shillings for each contract, which sum will be returned to *bona fide* offerors.

Endorsed Tenders are to be lodged with the undersigned not later than 12 o'clock noon on Monday, June 26th, 1905.

Harbour Engineer's Office, Aberdeen,
June 9th, 1905.

R. GORDON NICOL,
Engineer.

CITY AND COUNTY OF KINGSTON-UPON-HULL.

ELECTRICITY DEPARTMENT.

The ELECTRIC LIGHTING COMMITTEE of Kingston-upon-Hull are prepared to receive TENDERS for the SUPPLY, DELIVERY, and ERECTION of the UNDERMENTIONED PLANT:—

- One 500-kw. High-Tension Continuous-Current High-Speed Generating Set.
- One 500-kw. Low-Tension Continuous-Current High-Speed Generating Set.
- Six 30ft. by 8ft. 6in. High-Pressure Lancashire Boilers with Down-take Superheaters.

Copies of Specifications and Forms of Tender may be obtained on application to the City Treasurer (T. G. MILNER, ESQ.), Town Hall, Hull, on payment of a deposit of One Guinea in respect of each Specification required, such deposit being returnable on receipt of a *bona fide* Tender by the Corporation.

Sealed Tenders, endorsed "Tender for—," must be forwarded to the Town Clerk, Town Hall, Hull, on or before Thursday noon, June 22nd, 1905.

The Corporation do not bind themselves to accept the lowest or any Tender.

Sculcoates Lane, Hull, June 7th, 1905.

H. BELL,
City Electrical Engineer.

BOROUGH OF LEIGH, LANCs.

TENDERS are invited for the SUPPLY of ONE WATER-TUBE BOILER for the Electricity Department.

Specifications and General Conditions may be obtained on application to the Electrical Engineer, Mr. ARTHUR T. SMITH, on payment of One Pound, which sum will be refunded on receipt of a *bona fide* Tender.

Tenders to be delivered at the Town Hall, Leigh, Lancs., addressed to the Town Clerk, not later than Saturday, July 1st, 1905, endorsed "Tender for Water-Tube Boiler."

Town Hall, Leigh, Lancs.,
June 7th, 1905.

By Order,
STANLEY WILSON,
Town Clerk.

GREAT WESTERN RAILWAY.

ELECTRIC POWER AND LIGHTING.

The DIRECTORS of this Company are prepared to receive TENDERS for the SUPPLY, DELIVERY, and ERECTION of the FOLLOWING PLANT in connection with their Electricity Generating Station at Park Royal:—

SPECIFICATION 18.—Pipework, Feed and other Pumps, Tanks, Feed Heaters, Water-Softening and Oil-Separating Plant, &c.

Copies of the Specification, Form of Tender, Drawings, and General Conditions can be obtained on and after Monday, the 5th instant, at the Offices of the Consulting Engineers, Messrs. KENNEDY and JENKIN, 17, Victoria Street, London, S.W., between the hours of 10 a.m. and 4 p.m., on payment of Two Guineas for each Specification, which will be refunded on receipt of a *bona fide* Tender. The fee, which must be paid by cheque, will not be returnable until the Tenders have been adjudicated upon.

Tenders, addressed to "The Secretary, Great Western Railway, Paddington Station, W.," and marked outside "Tender for Pipework, &c., Specification No. 18," will be received not later than 10 a.m. on Monday, June 26th.

The Directors do not bind themselves to accept the lowest or any Tender, and no allowance will be made for any expense incurred in the preparation of a Tender.

Paddington Station, London,
1st June, 1905.

G. K. MILLS,
Secretary.

EAST INDIAN RAILWAY.—The East Indian Railway Company is prepared to receive TENDERS for the SUPPLY and DELIVERY of—

- (1) AIR COMPRESSOR, electrically driven, with motor complete;
- (2) STEEL PLATES for Boilers, &c.;
- (3) ROLLED MATERIAL for Engines and Boilers;

as per specifications to be seen at the Company's offices. Tenders are to be sent to the undersigned, marked "Tender for Air Compressor, with Motor," or as the case may be, not later than Twelve o'clock noon on Wednesday, the 21st day of June instant.

The Company reserves to itself the right to divide the order, also to decline any Tender without assigning a reason, and does not bind itself to accept the lowest or any Tender.

For each specification a fee of £1 1s. is charged, which cannot under any circumstances be returned.

By order,
C. W. YOUNG,
Secretary.

Nicholas Lane, London, E.C.,
June 8th, 1905.

APPOINTMENTS OPEN.

ASSISTANT CIVIL ENGINEERS IN

THE DEPARTMENT OF THE DIRECTOR OF ENGINEERING, &c., ADMIRALTY, AT HEAD OFFICE AND OUT-PORTS (23-28).—An OPEN COMPETITIVE EXAMINATION will be HELD in JULY, 1905. Technical training and qualifications necessary.

Applications must be received at the Civil Service Commission not later than June 28th, on printed forms to be obtained, with particulars, from the SECRETARY, Civil Service Commission, Burlington Gardens, London, W.

COUNTY OF LONDON.—THE LONDON

COUNTY COUNCIL invites APPLICATIONS from fully competent ENGINEERS with good experience in the design and construction of the PERMANENT WAY and general arrangement of ELECTRIC TRAMWAYS on the conduit system (if possible) and on the overhead system.

Candidates must be good surveyors, levellers, and draughtsmen, and able to prepare working drawings, specifications, quantities, and estimates, and to assist in supervising such work done by other assistants.

The rate of pay will be £7 a week, and applications will only be considered from persons with good previous experience in the class of work involved.

The appointment will be in the first instance of a temporary nature but with the prospect, at the expiration of about six months, of being made permanent, subject to the usual conditions attaching to appointments under the Council, should the work have been carried out in a satisfactory manner during that time.

Applications, giving full particulars as to age, qualifications, and experience, and enclosing copies of testimonials, must be made on forms, which may be obtained from the Clerk of the Council, County Hall, Spring Gardens, S.W., on and after Monday, June 5th, 1905.

The latest time for receiving applications, which must be addressed to the Clerk of the Council at the above address, is 10 a.m. on Tuesday, June 27th, 1905.

G. L. GOMME,

Clerk of the London County Council.

County Hall, Spring Gardens,
June 1st, 1905.

NORTHERN POLYTECHNIC INSTITUTE.

HOLLOWAY, LONDON, N.

REG. S. CLAY, D.Sc., Principal.

The Governors of the above Institute invite

APPLICATIONS FOR THE FOLLOWING

APPOINTMENTS to date from September 1st, 1905:—

CHIEF ASSISTANT in the Mechanical Engineering Department.

Drawing office and shop experience essential. Salary £150 per annum.

CHIEF ASSISTANT in the Architectural and Building Trades

Department. Salary £125 per annum.

Applications to be made on special forms, which must be returned not later than June 19th, to be obtained from

W. M. MACBETH, Secretary.

THE UNIVERSITY OF LIVERPOOL.

The Council invite APPLICATIONS for the VACANT CHAIR of ENGINEERING.

The income of the Chair consists of a fixed stipend and share of fees, and is guaranteed at not less than £900 per annum for five years.

Applications, with references and (if the candidate desires) testimonials, are requested not later than June 21st.

Further particulars on application to the Registrar.

BUYERS' DIRECTORY.

NOTE.—The display advertisements of the firms mentioned under each heading can be found readily by reference to the Alphabetical Index to Advertisers on pages 23 and 25.

In order to assure fair treatment to advertisers, each firm is indexed under its leading speciality ONLY.

Advertisers who prefer, however, to be entered under two or more different sections can do so by an annual payment of 5s. for each additional section.

Artesian Well Machinery.

John Z. Thom, Patricroft, Manchester.

Belting.

Binney & Son, Catherine Street, City Road, London, E.C.
Cort, Arthur, & Co., Camberwell, London, S.E.
Fleming, Birkby & Goodall, Ltd., West Grove, Halifax.
Gilmour, W. & O., St. John's Hill, Edinburgh.

Boilers.

Clayton, Son & Co., Ltd., Leeds City Boiler Works, Leeds.
Grantham Crank & Iron Co., Ltd., Grantham.
Hartley & Sugden, Ltd., Halifax.

Boilers (Water-tube).

Babeock & Wilcox, Ltd., Oriol House, Farringdon Street, London, E.C.
Stirling Boiler Co., Ltd., Motherwell, N.B.

Bolts, Nuts, Rivets, etc.

Herbert W. Periam, Ltd., Floodgate Street Works, Birmingham.
T. D. Robinson & Co., Ltd., Derby.

Books.

Crosby Lockwood & Son, Stationers' Hall Court, London E.C.
Griffin, Charles, & Co., Exeter Street, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.
Spon, E. & F. N., 125, Strand, W.C.
World's Work and Play.

Boring Machines.

Asquith, William, Ltd., Well Road Works, Halifax.

Case-Hardening Compounds.

Hy. Miller & Co., Millgarth Works, Leeds.

Castings.

Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.

Catalogues, Printing, &c.

Atlantic Press, Ltd., Weymouth Street, Manchester.
Southwood, Smith & Co., Ltd., Plough Court, Fetter Lane, London, E.C.
Spottiswoode Advertising Agency, Clun House, Surrey Street, Strand, W.C.
Stafford, Arthur, & Co., Denton, Manchester.

Chucks.

Fairbanks Co., 78-80, City Road, London, E.C.

Cisterns, Tanks, &c.

Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Clutches (Friction).

David Bridge & Co., Castleton Ironworks, Rochdale, Lancashire.

Colliery Plants.

Graham, Morton & Co., Ltd., Leeds.

Condensing Plant.

Benn, Sykes, Haslingden, near Manchester.
Concentric Condenser, Ltd., 23, Northumberland Avenue, London, W.C.
Mirrlees-Watson & Co., Ltd., Glasgow.

Consulting Engineers.

Gibbs, John, & Son, 80, Juke Street, Liverpool.
G. H. Hughes, A.M.I.M.E., 97, Queen Victoria Street, London, E.C.
Melville & Macalpine, 615, Walnut Street, Philadelphia, Pa., U.S.A.

Continental Railway Arrangements.

Northern Railway of France.
South Eastern & Chatham Railway Co.

Conveying and Elevating Machinery.

Adolf Bleichert & Co., Leipzig-Gohlis, Germany.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Graham, Morton & Co., Ltd., Leeds.
Temperley Transporter Co., 72, Bishopsgate Street Within, London, E.C.

Coverings (Boiler).

Magnesia Coverings, Ltd., Washington Station, co. Durham.

Cranes, Travellers, Winches, etc.

Joseph Booth & Bros. Ltd, Rodley, Leeds.
Thomas Broadbent & Sons, Ltd., Huddersfield.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Cranks.

Clarke's Crank & Forge Co., Ltd., Lincoln, England.

Cutters (Milling).

E. G. Wrigley & Co., Ltd., Foundry Lane Works, Soho, Birmingham.

Destructors.

Heenan & Froude, 4, Chapel Walks, Manchester.
Horsfall Destructor Co., Ltd., Armley, Leeds.

Dredges and Excavators.

Delange & Cie, Mée, Hoboken, near Antwerp.
Rose, Downs & Thompson, Ltd., Old Foundry, Hull.

Drilling Machines.

Asquith, William, Ltd., Well Road Works, Halifax.
Swift, George, Claremont Ironworks, Halifax.

Economisers.

E. Green & Son Ltd., Manchester.

Ejectors (Pneumatic).

Hughes & Lancaster, 47, Victoria Street, London, S.W.

Electrical Apparatus.

Allgemeine Elektrizitäts Gesellschaft, Berlin, Germany.
Broadbent, T. W., Victoria Electrical Works, Huddersfield.
Crypto Electrical Co., 3, Tyer's Gateway, Bermondsey Street, London, S.E.
Gent & Co., Ltd., Faraday Works, Leicester.
Greenwood & Batley, Ltd., Albion Works, Leeds.
India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., Silvertown, London, E.

Mathew & Platt, Ltd., Salford Iron Works, Manchester.
Matthews & Yates, Ltd., Swinton, Manchester.
Mix and Genest, Berlin, W., Germany.
Nalder Bros. & Thompson, 34, Queen Street, London, E.C.
New Gutta Percha Co., Ltd., Dashwood House, New Broad Street, E.C.

Newton Brothers, Full Street, Derby.
Phoenix Dynamo Manufacturing Co., Bradford, Yorks.
Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.
Turner, Atherton & Co., Ltd., Denton, Manchester.
B. Weaver & Co., 22, Rosoman Street, Clerkenwell, London, E.C.

Engineers' Supplies.

Ablers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Engines (Gas).

Campbell Gas Engine Co., Ltd., Halifax.
Soest, L., & Co., Ltd., 114-116, Victoria Street, London, S.W.

Engines (Electric Lighting).

McLaren, J. and H., Midland Engine Works, Leeds.

Engines (Locomotive).

Baldwin Locomotive Works, Philadelphia, Pa., U.S.A.
Hunslet Engine Co., Ltd., Leeds, England.
Hudswell, Clarke & Co., Ltd., Leeds, England.
McLaren, J. & H., Midland Engine Works, Leeds.

Engines (Portable).

Garrett, R., & Sons, Leiston, R.S.O., Suffolk.

Engines (Stationary).

Allis-Chalmers Co., 533, Salisbury House, Finsbury Circus, London, E.C.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Garrett, R., & Sons, Leiston, R.S.O., Suffolk.
Mirrlees Watson Co., Ltd., Glasgow.

Engines (Traction).

Jno. Fowler & Co. (Leeds), Ltd., Steam Plough Works, Leeds.
Garrett & Sons, Ltd., Richard, Leiston, R.S.O., Suffolk.

Engravers.

Jno. Swain & Son, Ltd., 58, Farringdon Street, London, E.C.

Exhaust Steam Oil Separators.

Lancaster & Tonge, Ltd., Pendleton, Manchester.

Fans, Blowers.

Capel Fan Co., 13, Moseley Street, Newcastle-on-Tyne.
Davidson & Co., Ltd., "Sirocco" Engineering Works, Belfast, Ireland.
Gibbs, John & Son, 80, Juke Street, Liverpool.
James Keith & Blackman Co., Ltd., 27, Farringdon Avenue, London, E.C.
Matthews & Yates, Ltd., Swinton, Manchester.

Fire Bricks.

J. H. Sankey & Son, Ltd., Essex Wharf, Canning Town, London, E.

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M. Glover & Co., Patentees and Saw Mill Engineers, Leeds.

Fountain Pens.

Mable, Todd & Bard, 93, Cheapside, London, E.C.

Forging (Drop) Plants.

Brett's Patent Lifter Co., Ltd., Coventry.

Forgings (Drop).

J. H. Williams & Co., Brooklyn, New York, U.S.A.

Furnaces.

Deighton's Patent Flue & Tube Company, Vulcan Works, Pepper Road, Leeds.

Leeds Forge Co., Ltd., Leeds.

W. F. Mason, Ltd., Engineers, Manchester.

Gas Producers.

Graham, Morton & Co., Ltd., Leeds.

W. F. Mason, Ltd., Engineers, Manchester.

Gauge Glasses.

J. B. Treasure & Co., Vauxhall Road, Liverpool.

Tomey, J., & Sons, Aston, Birmingham.

Gearing.

Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Asquith, William, Ltd., Well Road Works, Halifax.

Reid Gear Co., Linwood, near Glasgow.

Wild, M. B., & Co., Corporation Street, Birmingham.

Gold Dredging Plant.

Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Greases.

Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.

Hack Saws.

Baynes, Charles, Knudden Brook, Blackburn.

Hammers (Steam).

Davis & Primrose, Leith Ironworks, Edinburgh.

Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hoisting Machinery.

See Conveying Machinery.

Horizontal Boring Machines.

Asquith, William, Ltd., Well Road Works, Halifax.

Greenwood & Batley, Albion Works, Leeds.

Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hydraulic Leather.

Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Hydraulic Machine Tools.

Vauxhall and West Hydraulic Engineering Co. Ltd., 23, College Hill, London, E.C.

Icemaking and Refrigerating Machinery.

H. J. West & Co., 114-118, Southwark Bridge Road, London, S.E.

Indicators.

Dobbie McInnes, Ltd., 45, Bothwell Street, Glasgow.

Hannan & Buchanan, 75, Robertson Street, Glasgow.

Iron and Steel.

Imperial Steel Works, Sheffield.

Allen, Edgar, & Co. Ltd.

Askham Bros. & Wilson, Ltd., Sheffield.

Consett Iron Co., Ltd., Consett, Durham, and Newcastle-on-Tyne.

Fairley & Sons, James, Old Mint, Shadwell Street, Birmingham.

Farnley Iron Co., Ltd., Leeds, England.

Fried. Krupp, Grusonwerk, Magdeburg-Buckau, Germany.

Hadfield's Steel Foundry Co., Ltd., Sheffield.

J. Frederick Melling, 14, Park Row, Leeds, England.

Parker Foundry Co., Derby.

Purden, John & Sons, Lambhill Forge, by Maryhill Glasgow.

Walter Scott, Ltd., Leeds Steel Works, Leeds, England.

Gilbert Thompson & Co., 116, Victoria Street, London, S.W.

Ironwork (Constructional).

F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Ironwork (Galvanised).

F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Lagging Sheets.

Zeitz & Co., 21, Lime Street, London, E.C.

Lathes.

Asquith, William, Ltd., Well Road Works, Halifax.

Bradbury & Co., Ltd., Wellington Works, Oldham.

Eclipse Tool Manufacturing Co., Linwood, near Glasgow.

Leckenby, Benton, & Co., Perseverance Ironworks, Halifax.

Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.

Northern Engineering Co. (1900) Ltd., King Cross, near Halifax.

Swift, George, Claremont Ironworks, Halifax.

Lathe Carriers.

Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Laundry Machinery.

W. Summerscales & Sons, Ltd., Engineers, Phoenix Foundry, Keighley, England.

Lifts.

Waygood & Co., Ltd., Falmouth Road, London, S.E.

Lubricants.

Blumann & Stern, Ltd., Plough Bridge, Deptford, London, S.E.

Reliance Lubricating Oil Co., The, 19 & 20, Water Lane, Great Tower Street, London, E.C.

Matthew Wells & Co., Hardman Street Oil Works, Manchester.

Machine Tools.

Asquith, William, Ltd., Well Road Works, Halifax.

George Addy & Co., Waverley Works, Sheffield.

Bateman's Machine Tool Co., Hunslet, Leeds.

Bertrams, Ltd., St. Katherine's Works, Sciennes, Edinburgh.

Bradbury & Co., Ltd., Wellington Works, Oldham.

Breuer, Schumacher & Co., Ltd., Kalk, near Cologne-on-Rhine (Germany).

Cunliffe & Croom, Ltd., Broughton Ironworks, Manchester.

Dean, Smith & Grace, Ltd., Keighley.

Greenwood & Batley, Ltd., Leeds.

Jones & Lamson Machine Co., 97, Queen Victoria Street, London, E.C.

John Lang & Sons, Johnstone, near Glasgow.

Luke & Spencer, Ltd., Broadheath, Manchester.

Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.

Jos. C. Nicholson Tool Co., City Rd. Tool Wks., Newcastle-on-Tyne.

Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Noble & Lund Ltd., Felling-on-Tyne.

Northern Engineering Co., 1900, Ltd., King Cross, near Halifax.

J. Parkinson & Son, Canal Ironworks, Shipley, Yorkshire.

C. Redman & Sons, Halifax.

Rice & Co. (Leeds), Ltd., Leeds, England.

G. F. Smith, Ltd., South Parade, Halifax.

Swift, George, Claremont Ironworks, Halifax.

Taylor and Challen, Ltd., Derwent Foundry, Constitution Hill, Birmingham.

Vauxhall and West Hydraulic Engineering Co., Ltd., 23, College Hill, London, E.C.

H. W. Ward & Co., Lionel Street, Birmingham.

T. W. Ward, Albion Works, Sheffield.

West Hydraulic Engineering Co. (see Vauxhall and West Hydraulic Engineering Co. Ltd.), 23, College Hill, London, E.C.

Winn, Charles, & Co., St. Thomas Works, Birmingham.

Yorkshire Machine Tool and Engineering Works, Liversedge, Yorks.

Marks.

Pryor, Edward, & Son, 68, West Street, Sheffield.

Metals.

Delta Metal Co., Ltd., East Greenwich, London, S.E.

Magnolia Anti-Friction Metal Co., Ltd., of Great Britain, 49, Queen Victoria Street, London, E.C.

Phosphor Bronze Co., Ltd., Southwark, London, S.E.

Metals (Perforated).

W. Barns & Son, Chalton Street, Euston Road, London, N.W.

Mining Machinery.

Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Office Appliances.

Halden & Co., J., 8, Albert Square, Manchester.

Hall & Co., B. J., 39, Victoria Street, London, S.W.

Inglesant, T., & Sons, Ltd., Atlas House, Leicester.

Lyle Co., Ltd., Harrison Street, Gray's Inn Road, London, W.C.

Rockwell-Wabash Co. Ltd., 69, Milton Street, London, E.C.

Shannon, Ltd., Ropemaker Street, London, E.C.

Trading and Manufacturing Co., Ltd., Temple Bar House, Fleet Street, London, E.C.

Oils, &c.

Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.

Valor Co., Ltd., Rocky Lane, Aston Cross, Birmingham.

Wells, M., & Co., Hardman Street Oil Works, Manchester.

Packing.

Beldam Packing & Rubber Co., 93-94, Gracechurch Street, London, E.C.

Frictionless Engine Packing Co., Ltd., Hendham Vale Works, Harpurhey, Manchester.

Lancaster & Tonge, Ltd., Pendleton, Manchester.

Redfern & Co., S. Swan Lane, New Brown Street, Manchester.

Quaker City Rubber Co., Coronation House, Lloyd's Avenue, E.C.

United States Metallic Packing Co., Ltd., Bradford.

J. Bennett von der Heyde, 6, Brown Street, Manchester.

Paper.

Lepard & Smiths, Ltd., 29, King Street, Covent Garden, London, W.C.

Patent Agents.

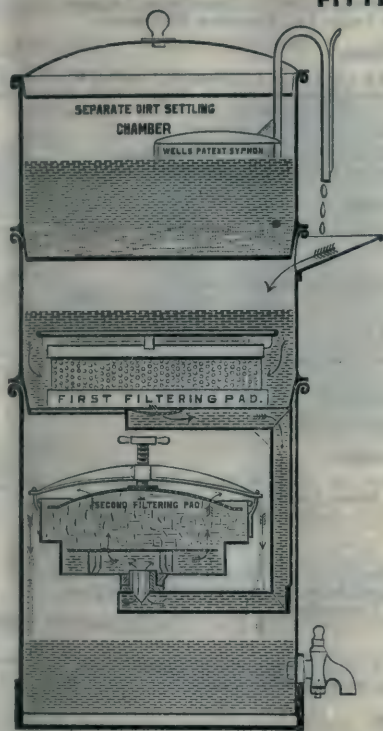
Page & Rowlingson, 28, New Bridge Street, London, E.C.

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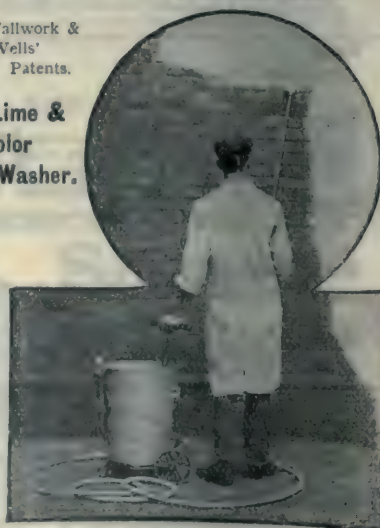
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Booker & Sullivan, 67 and 69, Chancery Lane, W.C.
Elliott & Fry, 55, Baker Street, London, W.

Pinch Bars.

Samson & Co., Garforth, near Leeds.

Pipe Wrenches (Chain).

Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Pistons.

Lancaster & Tonge, Ltd., Pendleton, Manchester.

Planished Sheets.

Zeitz & Co., 21, Lime Street, London, E.C.

Porcelain.

Gustav Richter, Charlottenburg, near Berlin, Germany.

Presses (Hydraulic).

Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Publishers.

Crosby Lockwood & Son, 7, Stationers' Hall Court, London, E.C.
Charles Griffin & Co., Ltd., Exeter Street, Strand, London, W.C.
Spon, E. and F. N., 125, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.

Pumps and Pumping Machinery.

Drum Engineering Co., 27, Charles Street, Bradford.
Enke, Carl, Schkeuditz-Leipzig, Germany.
Fairbanks, Morse & Co., 126, Southwark Street, London, S.E.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
J. P. Hall & Sons, Ltd., Peterborough.
Hathorn, Davey & Co., Ltd., Leeds, England.
Positive Rotary Pumps, Ltd., 23, Northumberland Avenue, London, W.C.
Tangyes, Ltd., Cornwall Works, Birmingham.

Radial Drilling Machines.

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Swift, George, Claremont Ironworks, Halifax.

Rails.

Wm. Firth, Ltd., Leeds.

Railway Wagons.

Nye, A. W., 110, Cannon Street, London, E.C.
W. R. Renshaw & Co., Ltd., Phoenix Works, Stoke-on-Trent.

Riveted Work.

F. A. Keep, Juxon & Co., Forward Works, Barn Street, Birmingham.

Roller Bearings.

Hyatt Roller Bearing Co., 47, Victoria Street, London, S.W.

Roofs.

D. Anderson & Son, Ltd., Lagan Felt Works, Belfast.
Graham, Morton & Co., Ltd., Leeds.
Head, Wrightson & Co., Ltd., Thornaby-on-Tees.

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Bullivant & Co., Ltd., 72, Mark Lane, London, E.C.

Scientific Instruments.

Cambridge Scientific Instrument Co., Ltd., Cambridge.

Spanners.

Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Stampings.

Thomas Smith & Sons of Saltley, Ltd., Birmingham.
Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Stamps (Rubber).

Rubber Stamp Co., 1 & 2, Holborn Buildings, Broad Street Corner
Birmingham.

Stamps (Metal).

Edward Pryor & Son, 68, West Street, Sheffield.

Steam Traps.

British Steam Specialties, Ltd., Fleet Street, Leicester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Steam Wagons.

Thornycroft & Co., Ltd., J. I., Chiswick, London, W.
Yorkshire Patent Steam Wagon Co., Pepper Road, Hunslet, Leeds.

Steel Tools.

Saml. Buckley, St. Paul's Square, Birmingham.
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Steel Structures.

Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.

Stokers.

Ed. Bennis & Co., Ltd., Bolton, Lancs.
Meldrum Brothers, Ltd., Atlantic Works, Manchester.

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S. Pegg & Son, Alexander Street, Leicester.

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A. Bolton & Co., 40, Deansgate, Manchester.

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Recorders, Ltd., 171, Queen Victoria Street, London, E.C.

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Premier Boiler Tubes, Ltd., 28, Victoria Street, London, S.W.
Thomas Piggott & Co., Ltd., Spring Hill, Birmingham.
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Turbines.

Greenwood & Batley, Albion Works, Leeds.
S. Howes, 64, Mark Lane, London, E.C.

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Elliott-Fisher Co., 85, Gracechurch Street, London, E.C.
Empire Typewriter Co., 77, Queen Victoria Street, London, E.C.
Yost Typewriter Co., 50, Holborn Viaduct, London, E.C.

Valves.

Holmes & Co., W. C., Huddersfield.
Hunt & Milton, Crown Brass Works, Oozells Street North
Birmingham.
Scotch and Irish Oxygen Co., Ltd., Rosehill Works, Glasgow.
Shaw, Joseph, Albert Works, Huddersfield.
Winn, Charles, & Co., St. Thomas Works, Birmingham.

Ventilating Appliances.

Matthews & Yates, Ltd., Swinton, Manchester.

Wagons—Steam.

Thornycroft & Co., J. I., Ltd., Chiswick, London, W.

Weighing Apparatus.

W. & T. Avery, Ltd., Soho Foundry, Birmingham, England.
Samuel Denison & Son, Hunslet Moor, near Leeds.
Graham, Morton & Co., Ltd., Leeds.

Wells Light.

A. C. Wells & Co., 100A, Midland Road, St. Pancras, London, N.W.

Wind and Water Supply Machinery.

Eric S. A. Smith, Bridlington.

Wire Working Machinery.

Ed. Brand, 35, Shakespeare Street, Manchester.

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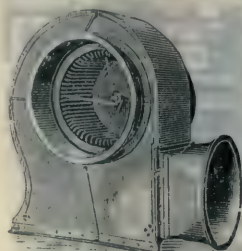
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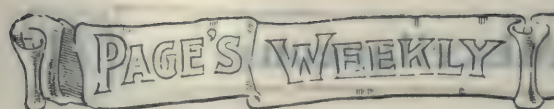


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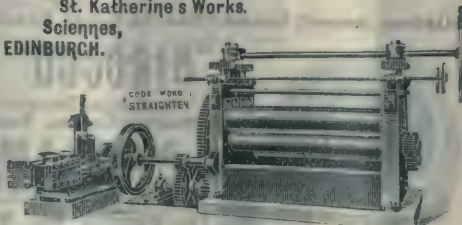
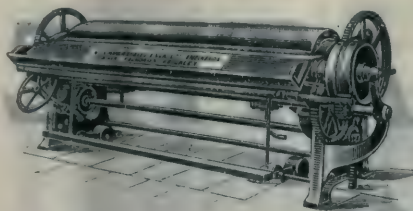


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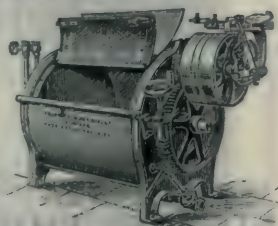
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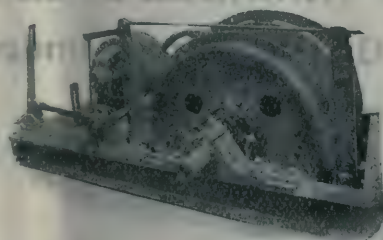
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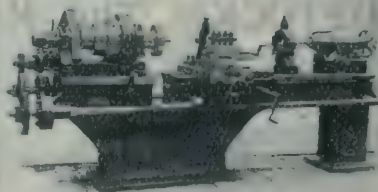
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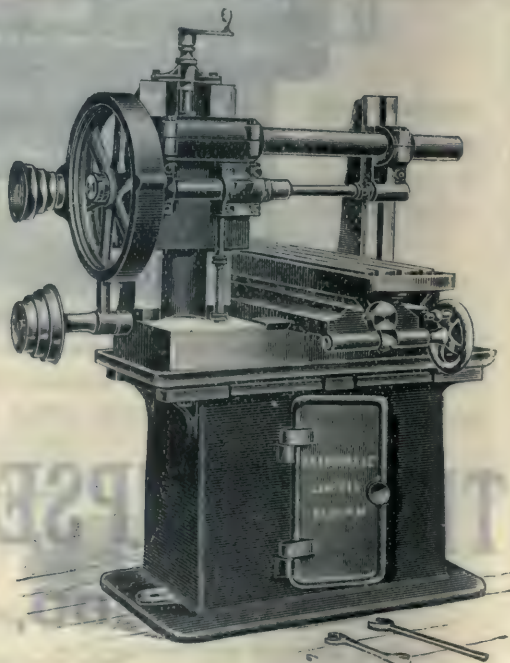
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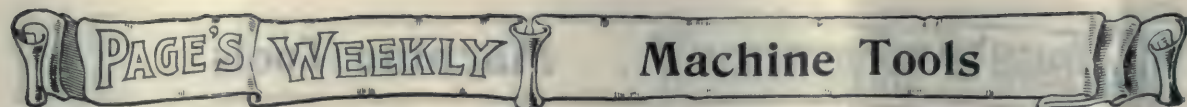
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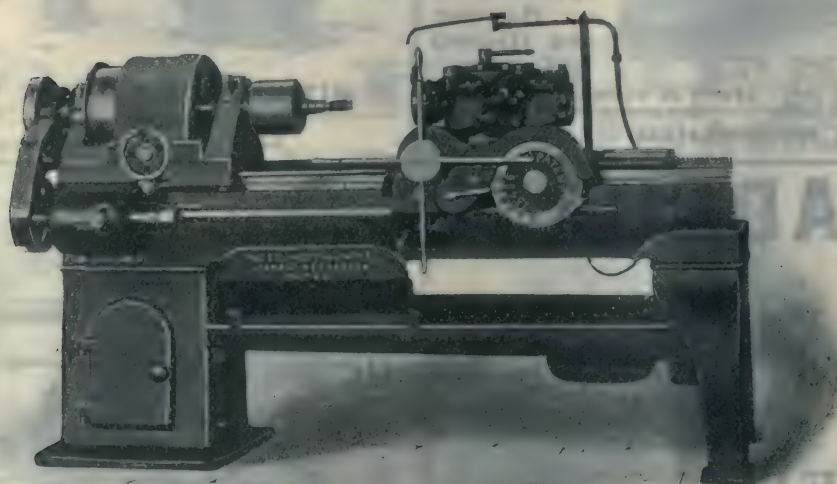


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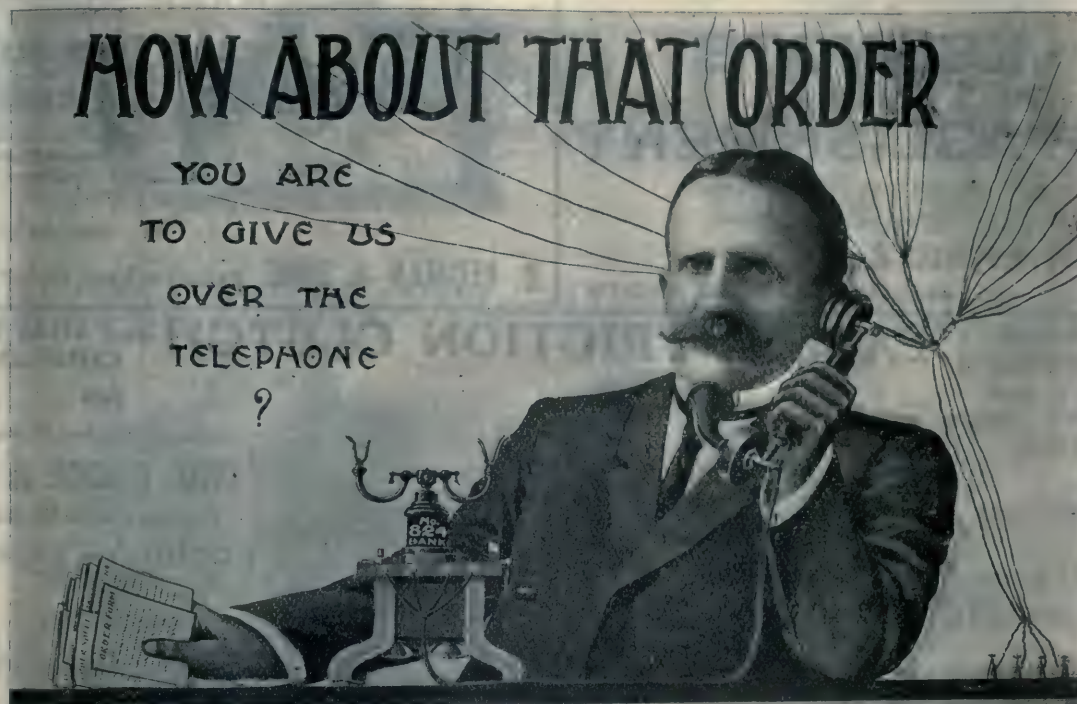
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Machine Tools.



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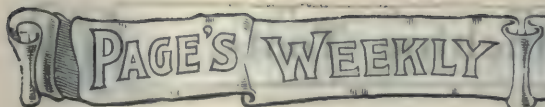
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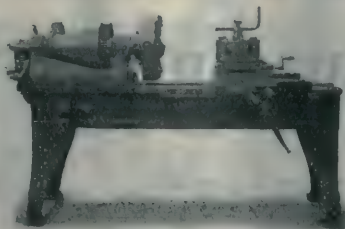
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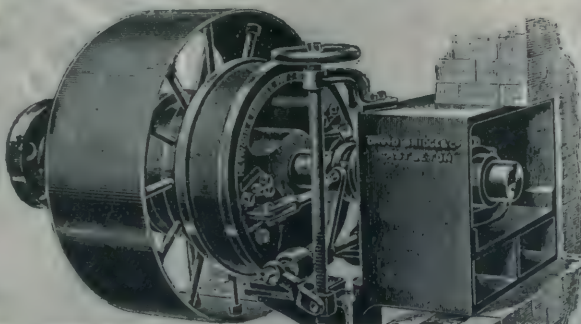
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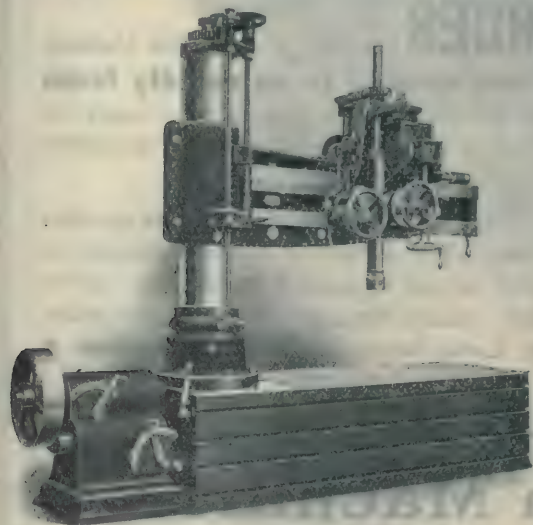
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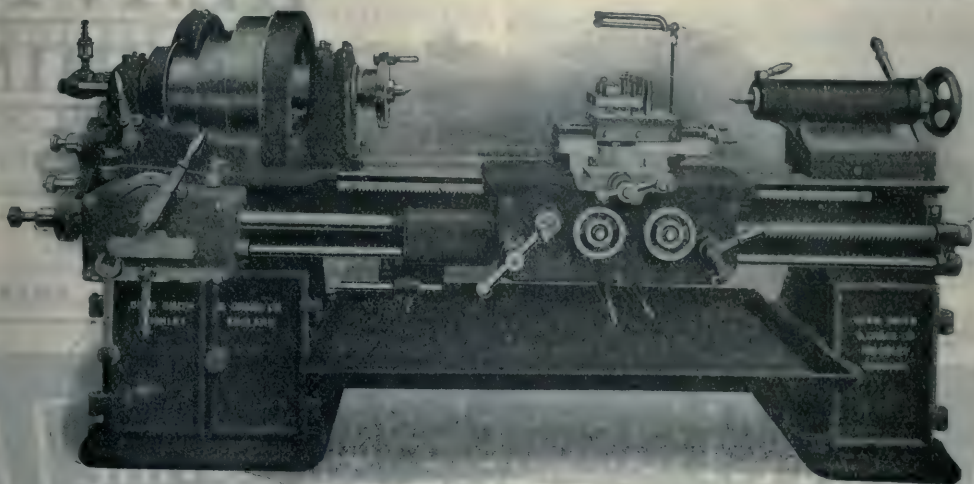
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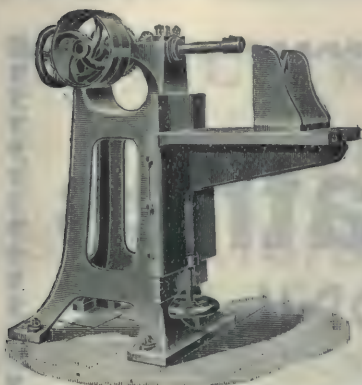
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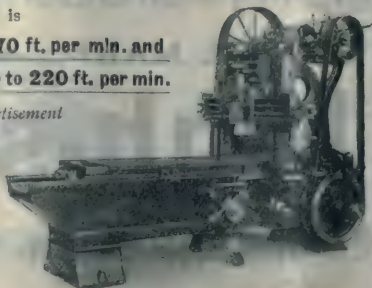
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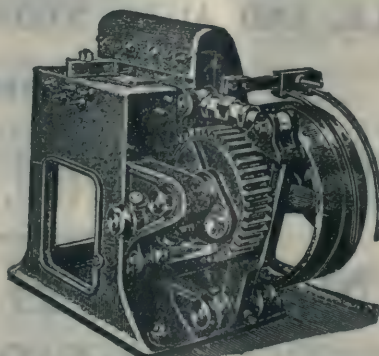
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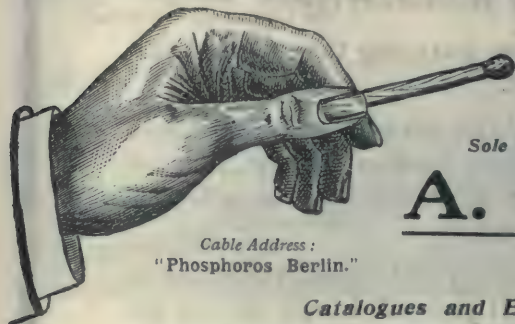
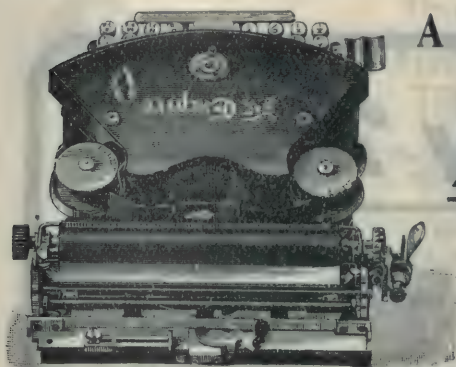
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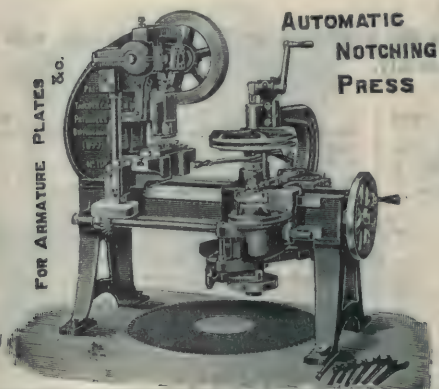
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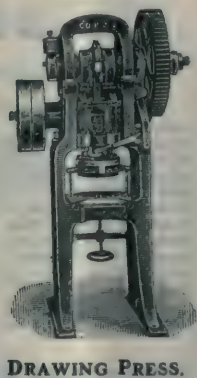
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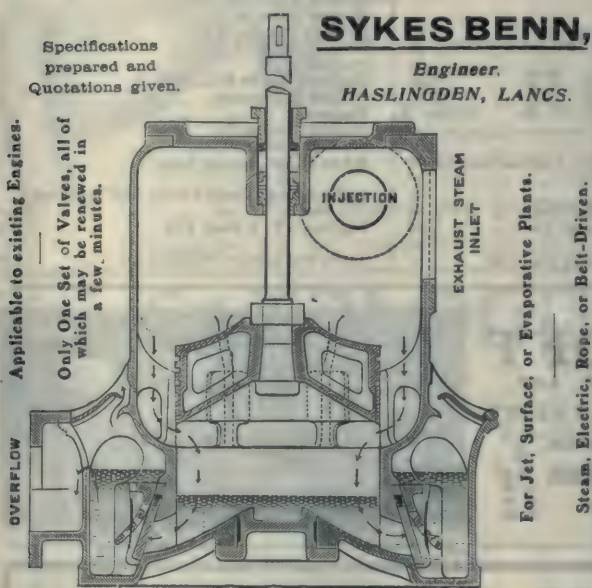


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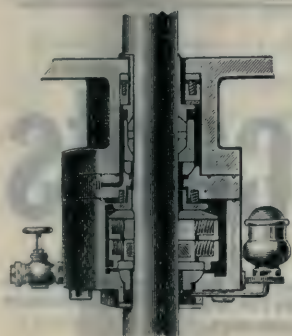
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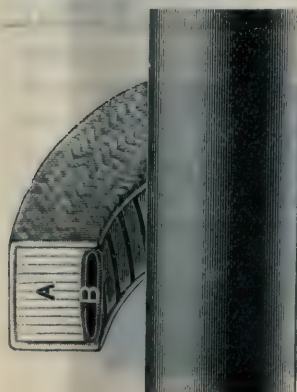
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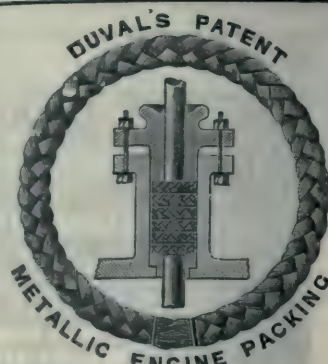


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PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

VOL. VI.

LONDON, FRIDAY, JUNE 16, 1905.

No. 40.

The Offices of "Page's Weekly," Wednesday Evening.

WITH the fate of A8 fresh in mind, more than usual interest attached to the lecture on "Submarines" which Sir William White delivered before the Royal Institution on Friday. The lecturer pointed out that the Holland type had been adopted by the British Admiralty, but regretted that he was unable to give a great deal of information about the British vessels, in consequence of the adoption of a policy of secrecy, which he stigmatised as unreasonable and unnecessary. The latest type of which particulars were available was understood to be about 150 ft. in length, with a displacement of 300 tons, fitted with gasolene engines of 850 h.p. for surface propulsion, giving a surface speed of 13 knots. The surface radius of action was about 500 miles. The under water speed was 9 knots and the radius of action when submerged about 90 miles. Sir William White pointed out that a number of vessels had been bought by Russia with the view of enabling work to be done on the bottom under water. Designs had been worked out for small submarines which could be stored on board large ships and transported to the scene of operations, but while this plan was perfectly feasible from an engineering point of view, no navy had yet adopted it. Sir William is of opinion that the adoption of higher under water speeds is a matter requiring very serious consideration.

Referring to the recent disaster he thought that the latest type of British submarine would compare with any afloat, but it must be recognised that it was impossible to get an advantage like that of submergence without corresponding risk, and the Navy never failed to meet any risk that was necessary in the performance of its duty. It appeared probable that the accident originated in connection with the gasolene engines, but he deprecated expressions of opinion, based, as they must necessarily be,



MR. SAM FAY,
General Manager of the Great Central Railway.

on incomplete knowledge, until the proper authorities had pronounced judgment.

It appears that a court of inquiry into the circumstances of the disaster to submarine A8 has already opened at Devonport, and it has been stated that the evidence went to show that the horizontal rudder was deflected, presumably owing to an error, whilst the submarine was running lightly with her full buoyancy and the cover of her conning tower open. Pending the conclusions of the official inquiry, however, our readers will readily endorse Sir William White's dictum, that an entire suspension of judgment is due to the unfortunate victims.

A writer in the *Scientific American* states that the highest velocity yet attained in America for a gun of large calibre was recorded not long ago in the army tests at Sandy Hook of the new Brown wire gun, when some rounds were fired with a velocity of 3,300 ft. per second. Another wire-wound gun, designed by General Crozier for the army, is nearing completion, and will shortly be subjected to test. The writer sums up the recent naval gun scare as follows:—It must be admitted that on the face of it the mere statement that some 12-in. guns had "cracked," sounds ominous. But when we come to examine into the construction of these guns, the location of the cracks, and their effect upon the strength of the gun, we find that the defects are of such minor consequence that the strength of the guns is not in the least affected. As a matter of fact the very powerful explosive, cordite, used in the British navy, exercises such a rapid scoring effect on the liner, that after a certain number of rounds have been fired, the guns must be returned to the factory for relining. The scoring of the gun is the penalty which the authorities are willing to pay for the sake of using a powerful explosive, whose bulk is not much more than half as great as that of the less powerful propellants which do not score the guns so severely.

As regards the statement attributed to the Russian Admiralty, that the battleships *Navarin*, *Borodino*, *Alexander III.*, and *Kniaz Souvaroff* "all turned turtle" and that not a single officer was saved, Sir Nathaniel Barnaby has just written a pointed letter to the *Times*. He says:—It appears to be considered, even by Admiral Togo himself, that the capsizing of these large ships was due to some fault in their design. I therefore ask your permission to say that in "Naval Development in the Nineteenth Century," published two years ago there is a discussion of this question in the chapter on "Armed Ships." Three sentences from this seem to be very much to the point:—

The modern ship of war, whether "protected" or "armoured," is in danger of capsizing, when wounded under water, to an extent unknown 50 years ago.

The increased risk of capsizing, before sinking, in the wounded ship of war of to-day, is not peculiar to any class, or to any navy.

Officers should have practical demonstration of the effect of wounds through the armour, and beyond the armour, and beneath the armour, and thus learn how much and how little the costly and elaborate arrangements for flooding and for pumping are worth

A Japanese expert lays down the cardinal causes of Admiral Rojdestvensky's defeat as being: (1) Imperfect reconnoitring; a thoroughly bad intelligence service. (2) Imperfect battle formation, with the lame ducks between the enemy and the powerfully armed battleships, thus masking the latter's fire and discouraging the Russians by early losses. (3) Weather conditions—wind against, and sun in the eyes of the Russians. (4) Waste of ammunition. It is believed that the surrender of Admiral Niebogatoff's squadron was owing to want of ammunition. (5) Marked inferiority of the Russian gunnery.

As a corollary to the highly satisfactory accounts of the industrial condition of Japan, which appears elsewhere in this issue, it is worthy of note that the trade of Korea, despite

the war, has shown remarkable growth, as evidenced by customs returns. As regards the exports of Korea, it cannot be said that as yet they are of any vast importance. Aside from gold, the minerals thus far developed consist mainly of iron, copper, and coal. A French company undertook the manufacture of briquettes from a kind of disintegrated anthracite found in North-Eastern Korea, but its operations were suspended by the war before the merit of the industry had been proved. A Korean company has also recently been organised, to mine what is claimed to be a more solid form of the coal found in the same region. It is reported that the company will shortly receive machinery sufficient to begin operations. Copper and iron mining seem to be solely in the hands of the natives.

In connection with the paper on "Cheap Electrical Energy for Power Purposes," reported in our last issue, we may call attention to another useful paper on the "Application of Electricity to Industrial Purposes," read by Mr. J. F. C. Snell before the North-East Coast of Institution of Engineers and Shipbuilders. In this Mr. Snell discusses the comparative economy between installations for the driving of machine tools laid down at the works themselves, and the purchase of electricity from an outside power station owned by either a separate company or by the municipality, the comparative advantages of direct current and alternating polyphase current, etc. As to comparative economy the author includes the following suggestive table for outputs of 100,000 or more units per annum :—

Load Factor. Per Cent.	Units per K.W. Demanded.	Price from Power Supply. Pence.	Price from own Local Station. Pence.
15	1,314	1'5	1'75
20	1,752	1'25	1'45
25	2,190	1'125	1'25
30	2,628	1'00	1'10
35	3,066	0'875	0'95
40	3,504	0'800	0'90
50	4,380	0'75	0'75
60	5,256	0'68	0'65
70	6,132	0'66	0'58
80	7,008	0'62	0'50

It is shown that the higher the load factor of a particular installation, the less reason is there for the purchase of power from an outside company, and the more excuse for installing one's own plant; that at a load factor of 50 per cent. the costs are identical and that for load factors above 50 per cent. the power can be more economically generated on the spot. But as this only applies to exceptional plants, such as pumping or paper mills, working continuously, and does not apply to engine works and shipyards having a load factor of under 40 per cent., the inference is that the greater number of works will benefit from co-operation by becoming consumers of one general power supply.

Mr. Snell takes the opportunity of strongly advising manufacturers to pay the small additional expense incurred by the fees of a recognised electrical expert to advise them upon the the application of electricity to their machines. It is lamentable, he says, to find that many of the economies which ought to be rightly obtained by the application of electricity, and by the initial expense which it necessarily incurs, are largely discounted by the absurd methods by which motors are applied to their work. In some cases, lines of countershafting are retained, so as to group a number of, sometimes quite large machines, driven by one large motor, running often at less than half load, or, in other cases, fans originally running at 200 r.p.m. are driven electrically at a much increased speed, and the necessarily increased power which the motors take up is a source of amazement to the manufacturer, who sometimes appears ignorant of the fact that as the speed increases, so the power required, cube: These are some of the practical mistakes which a professional consultant can and ought to be able to prevent. The adverse criticisms which occasionally fall upon electrical driving, in the author's opinion, create a real demand for experts of this class at the present juncture,

when the tendency is so much towards the adoption of electricity as the driving agent.

Although in the development of locomotion we are just now passing through a transition period, it is becoming obvious to most people that the further evolution of the motor-car can scarcely be unconnected with some kind of improvement in the organisation or structure of the roads traversed. The dust nuisance—to take one grievance alone—is a very real one in many rural districts, and is undoubtedly inimical both to life and health, while in many cases the cyclist—now representative of a very large class—has been actually driven from the road. As the pursuit of motoring is carried on by the few at the expense of the many, it is surely reasonable to anticipate that the special motor-car ways outlined by Mr. B. H. Thwaite in our correspondence columns will meet with the approval and financial support of the motoring public. Apart from the justice of the case, which clearly demands greater protection for the ordinary user of the King's highway, the special roads would offer to the motor-car man quite exceptional facilities for proving the capacity of his machinery.

Mr. Sam Fay, the general manager of the Great Central Railway, was born in 1857. His advancement in the railway service has been one of exceptional rapidity. He began his business career in 1872 as a junior clerk in the Traffic Department of the London and South-Western Railway, and in February, 1884, after frequent promotions, became chief of the staff of the superintendent of the line. Three years previously Mr. Fay had brought himself favourably under the notice of the directors and chief officials of the Company by founding the South-Western Gazette, a monthly periodical devoted to the interests of the South-Western Railway staff. Twelve months later he published a work entitled "A Royal Road"—a short history of the London

and South-Western Railway. In October, 1890, Mr. Fay was transferred from the traffic department to the position of assistant to the stores superintendent. He was appointed general manager of the Midland and South-Western Junction Railway in February, 1892. At the time of his appointment this small system was in the hands of a receiver, but during his seven years' tenure of general managership, Mr. Fay accomplished a great improvement in its financial standing. On the death of Mr. G. T. White, in April, 1899, Mr. Fay returned to the London and South-Western service to take up the position of superintendent of the line, in which capacity he further enhanced his previous reputation. On the retirement of Sir William Pollitt in 1901, Mr. Sam Fay was appointed to his present position as the general manager of the Great Central Railway.

Professor Perry has just given in the magazine of the Royal College of Science an informing and suggestive account of his visit to America. In the United States, he remarks, there is more chance for an inventor, for a clever workman; everybody welcomes a new thing, more systematic ways of doing old things. This atmosphere of discontent and of irreverence ought to produce far greater effects than it has done, but what can the most exhilarating atmosphere do upon badly educated men? It seemed to me that the best work in America was being done by men born and educated in England. In England the profits are greatly consumed by salaries paid to inefficient relatives of directors; in America there is almost nothing of this, but, unfortunately, in the last twenty years there has been so much unscientific trial and error, so much and repeated scrapping of obsolete machinery, that to give a decent dividend to shareholders it is necessary to charge customers twice as much for a thing—say, an electric unit—as we do in England. I looked round some of these great electric stations, perfect in detail, most expensively built, and wondered

if scrapping had yet finished, if these great steam turbines would not have to make way for gas or oil turbines in a few years' time. America has gone ahead too fast; with her, electricity had very little competition with gas and other older systems, and as a result she has been much less cautious and economical than we in all sorts of ways. I think that we have been too cautious; we are too much afraid to try new ways of working. When a system is working well we discourage the man who wants to upset it, even if we see that he might improve it. It is well known that the way of the inventor is hard, but we trust the Professor's remarks will not lead to a further exodus of British brains across the Atlantic.

The accompanying map illustrates a notable proposal explained by Mr. John M. Newton, C.E., at a recent meeting held at the Midland Hotel, Manchester. It is a scheme to provide Manchester with an express suburban line from Whitworth Park to Hazel Grove. Hale Barn and Hale Carr would be served by a branch going off between New Hale Green and Norcliffe, and Davenport by a branch extension from Bramhall. The main line would be some 16 miles long and the branches about $4\frac{1}{2}$ miles, a total of $20\frac{1}{2}$ on which it is proposed to put twenty-five stations. From Whitworth Park to Sale Bridge the line would be of the ordinary heavy type, but onwards from that point it would be to all intents and purposes a light railway. The proposed route is through a

sparsely populated country, the object of the line being to open up a suburban district ripe for development. The speed of trains would be 30 miles an hour, and the company would probably arrange to obtain their powers from the Corporations of Manchester and Stockport. The cost is estimated at about £450,000, with an additional £100,000 if the county council disallow level crossings. A resolution was carried expressing the opinion that the construction of the line was desirable, and a preliminary committee was formed to further the scheme. It is to be hoped that it will help to provide a vast army of city toilers with healthful suburban homes, and if carried to a successful issue, the project will doubtless be suggestive to other manufacturing centres. We understand that the route chosen does not involve competition with existing lines.



PROPOSED NEW RAILWAY FOR SOUTH MANCHESTER.

PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the
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Alterations, &c., intended for insertion in the current week's issue must be delivered **not later than 4 p.m. on Monday**. If proofs are required the copy and blocks should reach us several days earlier.

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MEETINGS, ETC., FOR THE ENSUING WEEK.

FRIDAY, JUNE 16.—Physical Society: Royal College of Science, South Kensington, 8 p.m.; Agenda: (1) "On the Ratio between the Mean Spherical and Mean Horizontal Candle Power of Incandescent Lamps," by Dr. J. A. Fleming, F.R.S.; (2) "The Electrical Conductivity of Flames," by Dr. H. A. Wilson; (3) "Contact with Dielectrics," by Rollo Appleyard; (4) "The Pendulum Accelerometer: an Instrument for the Direct Measurement and Recording of Acceleration," by F. Lanchester; (5) "A New Form of Pyknometer," by N. V. Stamford; (6) Exhibition of a Refractometer, by Rollo Appleyard.

WEDNESDAY JUNE 21.—Geological Society of London, Institute of Sanitary Engineers: Half-yearly General Meeting, 7 p.m.

THURSDAY, JUNE 22.—Municipal and County Engineers, Annual Meeting, Norwich.

NEWS ITEMS.

The Council of the Society of Arts have awarded the Albert Medal for the present year, with the approval of His Royal Highness the President, to the Right Hon. Lord Rayleigh, O.M., D.Sc., F.R.S., "in recognition of the influence which his researches, directed to the increase of scientific knowledge, have had upon industrial progress by facilitating, amongst other scientific applications, the provision of accurate electrical standards, the production of improved lenses, and the development of apparatus for sound signalling at sea."

The two "Atlantic" type De Glehn compound engines ordered by the Company from the Société Alsacienne de Constructions Mécaniques, have, says the Great Western Railway Magazine, been erected and tried under steam at the Belfort Works, and are now being taken to pieces for shipment to this country. They will be numbered 103 and 104, and are intended to work express trains between London and Plymouth.

The world's copper production for 1904 amounted to about 632,166 metric tons, as compared with 578,876 in 1903. The United States heads the list with 349,866 tons, Mexico being second with 52,500 tons, while Spain, which twenty-five years ago ranked first among the nations as a copper-producing country, now takes third place.

Mr. A. E. Grey, M.Inst.C.E., of 3, Victoria-street, S.W., has acquired the practice of the late Mr. William Jaffrey. The practice was originated by the late Mr. W. R. Kinipple in 1858.

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Data on Coal-Cutting Machines.

We illustrate herewith an excellent idea of Messrs. Mavor and Coulson, Ltd., who are sending out a card with the data shown regarding the performances of a Pick-Quick Long Wall Coal-Cutting Machine. A series of these data cards will be issued relating to the actual working results obtained, and should form a useful basis of comparison.

South African Association for the Advancement of Science.

The above title summarises the aims and objects of an Association which, though formed but two years ago, yet includes in its membership all the most prominent scientific men in South Africa. Anyone who takes an interest in science, either for its own sake or in its application to industrial purposes, is entitled to become a member, and the principal object of the annual meetings is to bring together all such people, in order that ideas may be freely exchanged. Two annual meetings have already been held—in Cape Town in 1903, and in Johannesburg in 1904—and this year the South African Association joins hands with

its prototype the British Association, and will hold its meetings with the latter, in August and September.

German Trade in 1904.

In a supplementary report on the trade of Germany for the year 1904, issued on June 6th, Mr. Consul-General Schwabach states that the volume of trade expanded considerably, while profits remained on the whole moderate. The expansion of trade was more noticeable in the finishing industries than in those producing raw materials. The production of coal (mineral coal and lignite) increased by 4·2 per cent.; the home consumption by about 4 per cent. This comparatively small increase was due to the reduced activity of those branches of the iron industry which manufacture heavy and half-finished goods. The production of pig-iron remained almost stationary, while the diminished exports of pig-iron were just balanced by the larger inland demand. In several branches of the machine building industry conditions were on the whole better than in 1903. Great activity prevailed in the electric and chemical industries, and the general condition of the textile industries was satisfactory.

Data Relating to a Pick-Quick Electric Coal-Cutter						
Mavor & Coulson, Ltd.		At a Lanarkshire Colliery			Glasgow	
Particulars of Seam	Thickness of Coal 2 Ft. 8 In.	Thickness of Dirt 0 Ft. 0 In.	Inclination of Face 1 in 6	Position of Holing At Pavement	Nature of Holing Coal	Character of Roof Good
Particulars of Face	Length 120 yards	Distance between Gateways 16½ yards	Distance from Face to Pack 4 Ft. 6 In.	Height at Face 2 Ft. 8 In.	Number of Men per place 3	Time required to Clear the Face 8 Hours
Particulars of Machine	Number 2505	Type Direct Current	Size Medium	Rails or Sledge Rails	Style of Bar Taper	Length of Bar 4 Ft. 0 In.
Consumption of Power (From Switch Board)	E.M.F. at Switchboard 480 Volts	Current 16 Amps.	Power Delivered to Circuit 7·68 K/W.	Power Expended by Motor 8·75 B.H.P.	Energy Used per Square Yard Cut ·205 Electric Unit	Energy Used per Ton Produced ·26 Elect. Unit
Labour at Machine and Rates per Shift	Machinemen 1 @ 6/6	Rail-Laying 1 @ 6/-	Timbering, etc. 1 @ 6/-	Clearing Holings 1 @ 5/6	Flitting 0 @ 0	Total per Ton 0 s. 2·7 d.
Labour, Getting, etc. Cost per Ton	Blasting 0 s. 0 d.	Getting and Filling 1 s. 2 d.	Traming to Haulage 200 Yards s. 2 d.	Stowing Dirt Included with Filling s.	Shearing and Heading and Day Work Included with Filling s.	Total per Ton 1 s. 4 d.
Costs per Ton Delivered at Haulage	Electric Supply @ 2d. per Unit s. ½ d.	Cutter Picks, Oil, etc. s. ½ d.	Timber s. ½ d.	Repairs, average over 12 Months 0 s. 0 d.	Interest & Depreciation at 1½ per cent. per Month on Coal-Cutter Cable, etc. s. 1 d.	Total per Ton Including Labour 1 s. 9·2 d.
Performance of Machine	Depth of Cut 3 Ft. 9 In.	Average Lineal Cut per Minute 18 Inches	Average Lineal Cut per Shift 120 Yards	Cutting Back & For Turning, or Flitting Back and Forward	Average Shift, Bank to Bank 8½ Hours	Shifts Worked during Month 23
Month's Production	Average Output per Shift 107 Tons	Month's Output 2455 Tons	Average Yield per Lineal Yard 18·2 Cwts	Proportion of Small 25 per cent.	Lineal Distance Cut during Month 2670 Yards	Face advanced during Month 25 Yards
Comparison with Hand Holing	Output to Haulage per Man per Shift 4·2 Tons	Previous Output per Man Hand Holing 2·5 Tons	Previous Cost by Hand Holing 2 s. 6 d. per Ton	Previous Proportion of Small 50 per cent.	Saving by Machine s. 9 d. per Ton	Increased Value of Output 10½d. per Ton

During 12 Months Working this Machine undercut 27,000 square yards, producing 20,000 Tons of Coal, without any Cost for Repairs, and at a Total Cost of 5s. for Renewals.

South Staffordshire and Warwickshire Institute of Mining Engineers.

At a recent meeting of the South Staffordshire and East Worcestershire Institute of Mining Engineers, Mr. Henry Johnson proposed that the name of the Institute be altered to "The South Staffordshire and Warwickshire Institute of Mining Engineers." He said he did so because of the close proximity of Warwickshire to South Staffordshire, and the undoubted connection there was between the two coalfields, also that it was felt that the Institute had comparatively little connection with East Worcestershire, due to that district having declined as a coal-mining district, whereas Warwickshire had assumed considerable importance, and its ground was well covered by the Institute. After some discussion the motion was seconded by Professor Redmayne, who remarked that the Institute was likely to have an intimate connection with Warwickshire in the future, as it was rapidly coming into the mining field and was likely to play an important part. Many Warwickshire engineers of note had already joined them, and he felt it was due to them that their position in mining enterprise should be recognised. They also had their headquarters in Warwickshire's capital. The resolution was unanimously carried.

The London University Degree in Mining and Metallurgy.

The long-promised syllabus in these subjects has been issued, and—says the Mining Journal—provided that a sufficient number of candidates is forthcoming, an examination will be held early in July. The delays caused by negotiation with the Home Office in the attempt to cause the degree to cover the requirements of the Coal Mines Regulation Acts Amendment Act, 1903, and the somewhat exhaustive knowledge required, probably render it impossible for the success of any candidate this year.

The final course appears to have been modelled almost entirely upon that pursued at the Royal School of Mines, and the syllabus in each subject is practically identical, though showing advances in some respects. It also differs in the fact that all the subjects of the examination are taken at once, while at the School the examinations are half-yearly, leading up to the specialised final at the end of the third year. Another point of variance is that at the School practical work in mines to the extent of 120 shifts under-ground are compulsory for the associateship in mining, while for the London degree they are not essential, though if performed the certificate is endorsed to that effect by the University. In this point London University

is following the lead of the University of Wales, whose degree in mining, however, is given after a two years' course.

The compulsory subjects for the final in mining are; Geology and Mineralogy, Electrical Technology, and Mining, including Mine Surveying and Assaying. One of the following must also be taken; Theory of Structures and Structural Design, Strength of Materials, Hydraulics. The syllabus in Electrical Technology is identical with the course instituted at the School of Mines during the last two years; the rest of the subjects, especially in mining and surveying, take the form of the syllabus of that college in a somewhat abbreviated form, and similarly include a knowledge of the occurrence of minerals and of surveying tacheometry and photogrammetry. A knowledge of the dry and wet assays of gold, silver, lead, copper and tin is also required. The final examination, in metallurgy including in addition Assaying, Mineralogy and Electrical Technology, while either the Theory of Structures or Strength and Elasticity of Materials must also be taken. The syllabus in Metallurgy is exhaustive; but, though such subjects as metallography and the new steels are to be dealt with by the student, there is no mention of electric smelting, and the newest applications of aluminium. The syllabus in practical metallurgy is particularly good, and the visiting of works by students is encouraged.

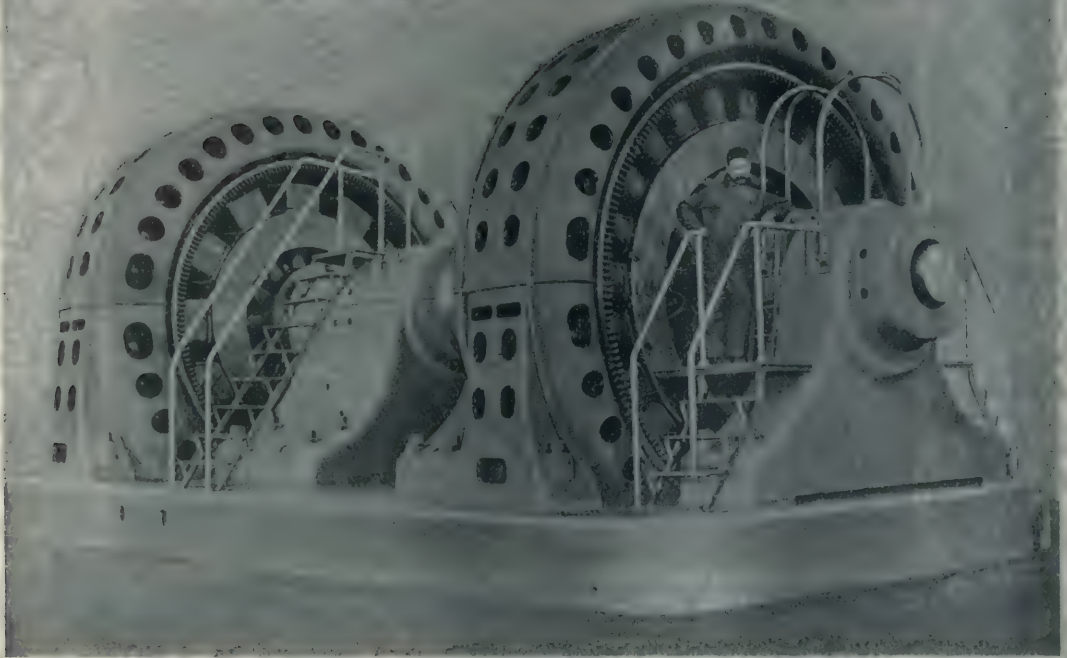
In addition to the pass in both subjects, an honours degree is also to be granted. This differs from the former only in the rendering of one more subject compulsory, and in the requirement of a higher standard of efficiency. There is no mention of a D.Sc. degree, as yet, in either of the subjects. The B.Sc. degree may be obtained by the carrying out of a suitable research by a student who has passed the intermediate examination, but it is expressly stated that this method can be permitted only as an exceptional and strictly supervised means of access to an honours degree, and not as an ordinary alternative to the pass examination.

Twenty-ton Electric Travelling Crane for Durban.

We illustrate on the opposite page a 20-ton electric travelling crane recently constructed by Messrs. Stothert and Pitt, Ltd., of Bath, for Durban harbour works. The most striking feature is its long span of 135 ft. 8 in. There are two lift speeds—10 and 20 ft. per minute—the cross-traversing speed being 120 ft. per minute, and the travelling speeds 100 or 300 ft. per minute. The lifting and traversing motions are operated by separate motors of 20 and 12 h.p. respectively, and the travelling motion by two 40-h.p. motors, arranged for series-parallel control.



ELECTRIC CRANE BUILT BY MESSRS. STOTHERT AND PITT, LTD., OF BATH, FOR THE NATAL GOVERNMENT.



ELECTRICAL INSTALLATION AT SHAWINIGAN FALLS.

Shawinigan Electric Plant.

A Canadian correspondent writes that the largest electric motor ever built is now being installed at the plant of the Shawinigan Water and Power Company, Shawinigan Falls, Quebec. This was recently constructed by Allis-Chalmers Company at their electrical works in Cincinnati, and embodies in its design the characteristics of the Bullock alternators, which have proved singularly successful in their application. It is a synchronous motor of 8,000 h.p.

The rating of the generator operated by this motor on standard specifications, is 5,750 kilowatts at 300 revolutions per minute. The combined machines, in addition to their enormous capacity, are remarkable for concentrating in an exceedingly small floor space a volume of 12,000 kilowatts.

The photograph of the machines, which is shown herewith, was taken while they were being tested at the shops, by the Behrend system, under full load conditions corresponding to 7,200 kilowatts on the generator, with the expenditure of no more than 300 kilowatts in order to produce the same losses in the machine which exist under full-load conditions.

The working of the generator and motor forming the frequency changer at Shawinigan Falls will be carefully noted by electrical engineers in all parts of the world, and if it is as successful as the builders confidently anticipate, the result will be a valuable addition to existing data on the subject of alternating-current machinery.

Economic Products of the Empire.

Among the branches of work now carried on by the Imperial Institute at South Kensington are the scientific investigation of the economic products of the British Empire with a view to their commercial utilisation, and the superintendence of the arrangement and classification of the collection of these products as exhibited at the Institute. From time to time samples and specimens of raw and manufactured products will be shown in the sample room at 73, Basinghall-street. In consequence of the transfer of the Imperial Institute to the Board of Trade from the beginning of 1903, the work formerly carried on by the Commercial Intelligence Office of the Imperial Institute is now conducted by the Commercial Intelligence Branch of the Board of Trade.

MINE SAMPLING AND ORE VALUATION.

BY JAMES PARK, M.Inst.M.M. ; M.A.Inst.M.E. ; F.G.S. ; Professor of Mining Geology, Otago University.

IN the majority of mines sampling proceeds simultaneously with the mine development, the results being recorded on assay-plans, which are generally longitudinal or stope-plans. Where the sampling during development has been carefully and systematically done, the averages should approximate to those obtained by the mine-examiner.

SAMPLING EQUIPMENT.

This includes new sample bags of canvas or stout calico, say, 14 in. long and 9 in. wide ; a canvas sheet, about 6 ft. long and 5 ft. wide ; a short-handled 4 lb. or 5 lb. hammer ; a gad or two ; small linen tape or foot-rule ; a number of small metal tags or strips of soft wood, each with a distinctive number or mark, and a stout canvas lock-up sack for the safe custody of samples.

PRACTICAL SAMPLING.

Begin the sampling of a level at the end of the main cross-cut, or at some point easily located with respect to a survey peg on the mine plan. When the whole width of the vein or seam is exposed in the drive it is customary to sample the higher or footwall portion lying on the back of the level, as the lower portion may be partly underfoot, and often covered with mud and water. Divide the level into sections of 5 ft., 10 ft., or more, according to the extent of the open ground and character of ore. Mark the divisions with chalk, or by blackening the wall with a candle-flame. With respect to the sampling intervals, it is well to remember that a large number of small samples taken at short intervals are often more reliable than a

small number of large samples taken at wide intervals. When the ore is known to be consistent in value, and is exposed in long stretches, the sampling intervals may be 20 ft. apart ; but when the vein is somewhat irregular in width and value the 5 ft. intervals will give the most confident results.

RECORD OF SAMPLES.

Carefully measure and record the width of the vein in feet and inches at each interval. A simple and accurate method of recording the sampling intervals, widths, and sample numbers is to draw a diagram in field-book representing a longitudinal section of the level. On this diagram, which need not be drawn to scale, all the necessary information can be shown graphically. This method has also the further advantage that the assay-values can afterwards be filled in at the different intervals, thus completing the record. The widths, numbers, and values are commonly recorded on mine assay-plans in different coloured inks, according to the individual fancy of the engineer ; but this is not necessary in the examiner's field-book, which is a private record.

BREAKING THE SAMPLES.

Dress the face down with a pick, so as to expose a fresh surface, and, if necessary, clean it with water. With the hammer and gad break a sample at each interval, allowing the material to fall on to the canvas sheet, or into a stiff felt hat held by an assistant. The sample is taken from a groove cut at right angles to the plane of the dip, or, in other words,

across the thickness from wall to wall, as shown in annexed figure, at the sampling intervals marked 1-8.*

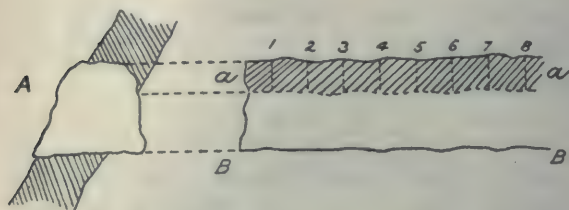


FIG. 1.

A, Cross-section of mine-level; BB, longitudinal section of level, showing sampling intervals 1-8; aa, vein exposed back of level.

In ore of fairly uniform hardness the width of the groove will vary from 4 in. to 6 in. and from $\frac{3}{4}$ in. to $1\frac{1}{2}$ in. deep. The sample will generally weigh from 2 lb. to 10 lb. for every foot of vein or bed. When the vein-matter is arranged in distinct bands of crustification—this is with a comb-structure—it is advisable to sample each band separately to determine where the values lie. Wide lodes should also be sampled in widths of 2 ft. or 3 ft., as sometimes the values are carried by the footwall portion; sometimes by the hanging wall or central portion. In such cases a single sample taken from wall to wall may convey quite an erroneous impression as to the commercial value of the lode.

Where a level is driven on a wide lode, only a small portion of the ore is exposed for examination. In such cases it is customary for the management during the progress of development to cross-cut the lode at intervals of 20 ft. or 50 ft., according to the metalliferous character of the ore. These cross-cuts will afford the examiner an opportunity of sampling the lode from wall to wall in such manner as the case may require. Where there are no cross-cuts, through the lode from the level, the full, or

at any rate, the payable, width of ore will generally be found exposed in the stopes.

It often happens, in the case of flat-lying veins, that the level has been driven on the footwall of the vein, or that the level has been timbered for the stoping. In these cases there is no exposure of the ore in the level, and the samples must be obtained from the stopes overhead. When sampling a lode composed of very soft, friable, or sugary ore, it is advisable to expose a fresh surface by cutting a groove 6 in. or 8 in. wide and several inches deep. The material from this groove is rejected, and the assay sample broken down from the fresh surface exposed in the cut. With uniformly soft material throughout, a pick may be safely used in breaking the samples; but with hard ores, or ores containing hard and soft patches, the hammer and gad must alone be used, as the pick is liable to find the soft places more frequently than the hard, with the result that a relatively larger proportion of the soft ore is broken than of the hard. If the softer material is richer than the harder, as it often is, manifestly the sample will be unduly enriched; but if poorer, then the sample will be impoverished. In any case the assay value will not represent the true value of the ore.

SAMPLING ON FLOOR OF LEVELS.

In cases where the ore has been stoped out above a level it may be necessary to sample the vein along the floor. Here the rails, sleepers, water, and sediment will increase the difficulties of the sampler. The blasting will have shattered the ore, and the interstices will have become filled with sediment either richer or poorer than the ore itself. In these circumstances the sampling must be conducted with much care and judgment.

SAMPLING SPECIMEN VEINS.

The valuation of gold-bearing veins in which the gold occurs in isolated bunches or patches at irregular intervals, or only at the intersection of cross-veins or indicators, is impossible by

* NOTE.—In some cases it is necessary to square the vein on the back of a level or stope in order that the true width from wall to wall may be exposed for sampling.

the ordinary methods of sampling. Even bulk or battery tests are not to be relied upon, as the values generally lie in a very small space. Thus, while hundreds of ounces of gold may be found in the space of a few yards, the ore for long stretches on both sides may contain no gold whatever. The valuation of such properties is a problem of almost impossible solution.

SAMPLING OF STOPES.

Stopes are merely a succession of horizontal drives. They are sampled in the same manner as levels. Samples are broken from the back, sides, and working faces, according to circumstances.

When the width of the vein is less than the width of the stope, the vein and the rock must be sampled separately, the widths of each being carefully noted.

SAMPLING OF WINZES.

Ore exposed in rise and winzes is valued by breaking samples at 5 ft. or 10 ft. intervals from grooves cut at right angles to the plane of the dip. The thickness of ore is measured and recorded on a diagram in the field-book, together with the sample number at each interval.

WEIGHT OF SAMPLE.

The weight of the sample broken down will vary with the width and hardness of the ore. When it is larger than the capacity of the sample-bag, the sheet must be carried to a convenient place underground, and its contents broken down to the size of a walnut. When this has been done, the sample is thoroughly mixed, formed into a very flat truncated cone, and quartered. Two opposite quarters are rejected, being removed completely with all their fines from the sheet. The material in the two remaining quarters is then broken down to a size half the diameter of a walnut, thoroughly mixed, and again quartered.

The two quarters lying in the position of the two quarters retained in the first operation are rejected and removed from the sheet.

A common method of mixing the ore on the sampling-sheet is to toss the material from one side to the other. In this process care must

be taken to insure that the fines are not concentrated in one particular part of the sample, but evenly distributed throughout the whole mass before each quartering.

In three-quarterings, a sample weighing 80 lb. will thus be cut down to 10 lb., which is about the maximum capacity of sample-bags.

The time required to break down a sample will depend upon the hardness and size of the lode. It seldom is less than half an hour, and may extend to several hours, depending upon the number of quarterings needed to reduce the sample to a convenient weight. The sampling of a large mine may occupy several weeks, and run into a cost of several hundred pounds.

ASSAY OF SAMPLES.

The whole of the sample should be dried, crushed in a rock-breaker in the laboratory to pass through a 10-mesh sieve, mixed, and sampled by quartering till reduced to a pound or two in weight, all of which should be finally pulverised, passed through a 60-mesh sieve, again mixed, and divided into two portions. One portion is handed to the assayer, while the other is retained as a duplicate sample for subsequent reference and verification if the necessity should arise.

Carelessness in the laboratory may stultify all the care exercised in the sampling underground. If the mine-examiner submit his samples to an assayer whose qualifications are unknown to him, he should take care to be present during the crushing, pulverising, and final division of the assay samples.

The duplicate samples should be put into small calico or stout brown-paper bags, labelled, and secured in a lock-up sack, which should be removed from the laboratory. The examiner's samples should never be submitted to the mine-assayer; and only in very exceptional circumstances should the samples be placed in the hands of an unknown assayer.

(To be continued.)

CORRESPONDENCE.

PROPOSED SPECIAL ROADWAYS FOR MOTORISTS.

29, Great George Street,
Westminster, S.W.

June 9th, 1905.

To the Editor of PAGE'S WEEKLY.

SIR,—It was realised some years ago that the speed possibilities of mechanically-propelled carriages would justify and eventually necessitate the provision of special trunk carways, and I formulated in the pages of *The Autocar*, *The Car*, and the *Car Magazine* a proposition and special design for such carways, and defined a route for a Birmingham and London carway, and in the *Nineteenth Century* I formulated further a proposition for a carway through England.

The main arguments set forth were as follows :—

1st. That a well-designed and appropriately constructed road surface, if freed from the pulverising effect of horses' hoofs, the cutting influence of metallic tyres, etc., and only exposed to the rolling contact of elastic or pneumatic tyres, with well-distributed loads, would be very durable compared with any ordinary King's highway.

2nd. That goods could be delivered direct from factory or warehouse to customers' premises with the minimum risk of breakage. The road designed by the writer includes in the first instance side tracks for cyclists, the central way being confined to the use of motor-cars. Passing places at suitable distances permit vehicles to pass each other. Eventually the success of such motor-carways would permit them to be widened into a double track. At certain of the passing places refreshment and resting pavilions and electric charging stations and motor-car stores are to be provided.

The motor-carways proposition assumed that a motor-bus system would be established and that the carway would be utilised for high speed motor-wagons (with elastic tyres). No wagon of any sort having metallic tyres would be permitted.

The structure of the roadway would have an asphalted rolling surface or equivalent system that avoids the use of joints, so that any destructive tendency due to the suction effects of a depressed and rolling tyre to remove the material composing the road joints would be minimised to the utmost extent. The fact that motor-cars mount exceedingly stiff gradients makes the selection of a suitable route much easier and the construction of the motor-road far less costly than that of a railway.

The line of route selected for the Birmingham-London carway proposition leaves Birmingham by Bickermill, and enters London by the Edgware Road. No doubt the success of this carway would be followed by its extension south of London to Brighton.

The earliest of the writer's propositions was for a carway right through England and Scotland following near the route of the Great North Road. Such a carway would certainly follow the economic justification of the system by actual use of a carway, and connecting Birmingham and London, and would solve the burning question whether motor-cars should be permitted to drive pedestrians and vehicular traffic from the King's highway.

Carways exclusively devoted to the motor-car and cycle service, the delightful and exhilarating effect of high speeds could be secured with danger, if any, only to the participants of this modern system of transit.

When the motor-cars entered into the public highway their speed could legislatively be limited to that of a fast-trotting horse, and without much real sacrifice of speed, because the motorist would only be in the position of a railway passenger living at a distance from the trunk railway line. On the latter he travels at express speed, but on the local or cross country lines the speed is often anything but express. The motorist would travel at a high speed—the maximum safety allowable on the carway and slow down on the public highways. It would be regrettable in the extreme if this last and most interesting development of modern applied science to locomotion is permitted to be suppressed by further legislation, which is rapidly becoming imperative in the interests of the public at large. The real and only solution of the problem is, I hold, the provision of special carways which, with a reasonably proportioned toll and cycle subscription, could not fail to become popular for all kinds of motor traffic, and would provide a profitable field for capital investment and especially if the Parliamentary powers permitted building on each side of the carway to be acquired on option terms. Unlike railway permanent way, there is no reason why the construction of carways should in any material extent disfigure the landscape. Moreover they would open up agricultural districts which have been neglected through the advent of the railways.

Sincerely yours,

B. H. THWAITE.

The Cooper-Hewitt Mercury Vapour Converter.

THE accompanying illustrations show the mercury vapour apparatus which has been designed by the Cooper-Hewitt Electric Company, of New York, for charging small storage batteries from a single-phase alternating-current supply. Apparatus somewhat similar in character may be used for obtaining direct current for most purposes for which such current is used. We are indebted to the company for the following details of this interesting development:—

Apparatus similar to the direct-current mercury vapour lamp when provided with one or more additional positive electrodes may

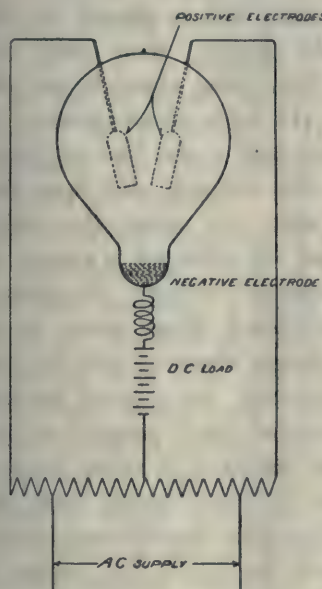


FIG. 1. DIAGRAM OF CONNECTIONS.

be used to obtain direct current from an alternating supply, the container being made short and of large cross section. Such a device is called a "Mercury Vapour Converter" or "Vapour Converter." The possibility of the

conversion of alternating into direct current depends upon the laws which underlie the well-known starting characteristics of mercury vapour lamps. The method by which the result is accomplished may be apprehended by referring to the diagram, which shows an exhausted container with two positive electrodes and one negative electrode. Since as in the mercury vapour lamp, no electrode will allow current to enter it until its starting or "negative electrode" resistance is overcome, the positive electrodes will pass current only in a given direction and oppose all current flow in the opposite direction. Consequently, current flows through the negative electrode in one direction only, which gives the desired direct current. It is, of course, assumed that the starting resistance of the "negative electrode" has been overcome in starting the converter and that this resistance is not permitted to re-establish itself. Since at the zero point of the electro-motive-force wave the current would naturally drop to zero, a choke coil is used to cause a lag in the current from either positive, which will carry the current over the zero point of the E. M. F. supply.

It is evident from the method of operation of the vapour converter that current is drawn from the supply during each alternation. A certain voltage is absorbed in the converter bulb, and this voltage, which amounts to about 15 volts, is practically independent of the value of the current flowing, within the working range of the apparatus. The energy represented by this voltage appears as heat and a slight amount of light within the bulb. The heat is carried to the inner surface of the glass by the condensing mercury and there dissipated into the air.

To overcome the starting resistance of the negative electrode in order to put the apparatus in operation, a supplementary electrode of mercury is used. The converter is tilted until the mercury of the supplementary electrode connects with that of the negative electrode when current passes between the two. The converter is then tilted back and the electrodes separate and the converter starts into operation; for the fact that the current has already been established between the electrodes before their operation prevents the establishment of the "negative electrode" resistance.

The present standard design provides for 30 amperes direct current and a direct-current voltage of from 80 to 115. The converter bulb as shown in illustration is an exhausted glass globe, about 9 in. in diameter, containing the electrodes. It is mounted in a metal ring, supported on knife edges to allow the tilting motion for starting. The sustaining coil—an inductance coil mounted below the bulb resembles in appearance a small transformer.

It serves to steady the direct current and bridge the zero point of the electro-motive-force wave of the supply. The regulator—an adjustable inductance coil—is mounted behind the panel and serves to control the current strength. A marbleised slate panel is provided with a direct-current ammeter and a direct-current voltmeter, and the handle of the regulator, as well as the switches controlling the alternating and direct currents. The auxiliary apparatus includes tilting magnet, cut-out for tilting magnet, small resistances, supporting frame, slate terminal board, etc. The auto-transformer is mounted separately and serves to adapt the voltage of the supply to the direct-current voltage, and also to furnish the middle point of the alternating supply. When the supply voltage exceeds 450 volts a lowering transformer is used in place of the auto-transformer. This former usually requires a special secondary and is not included in the outfit.

It is claimed that in general the efficiency is considerably higher than that of motor-generator sets, being about 80 per cent. when supplying 115 volts direct current. Since the chief energy loss is the loss in the converter, and since this depends only upon the current strength and not upon the direct-current voltage used, the efficiency is greater the higher the direct-current voltage. On voltages below 115 the efficiency drops below 80 per cent., and on voltages above it will be higher. The vapour converter has a great advantage over motor-generator sets, rotaries or generators, in that the efficiency is rather higher on light loads than on heavy loads, while with other types of apparatus the efficiency drops off very rapidly with the load. The vapour converter has also advantages over the motor-generator outfit in its lightness, the small floor space it requires and its absence of moving parts. We include the accompanying photo by courtesy of the British Westinghouse Company, who are acting as agents for the apparatus in this country.

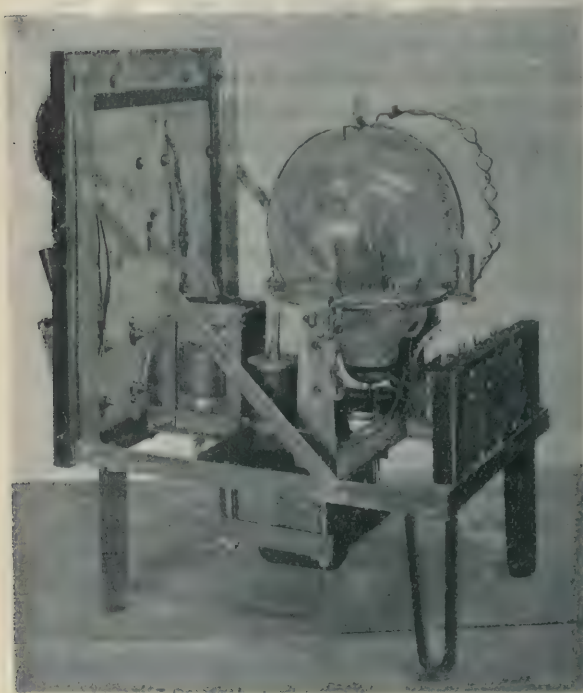


FIG. 2. REAR VIEW OF THE CONVERTER.

SPECIFIC HEAT OF SUPERHEATED STEAM.

BY A. H. PEAKE, M.A., A.I.E.E.

IT is well known that if dry saturated steam be allowed to expand without doing external work, and without losing heat, it becomes superheated. The direct object of the experiments now to be described was to determine the law connecting the temperature and pressure of superheated steam during this free expansion; then from this law and Regnault's tables of the total heat of saturated steam, the degree of superheat, and the amount of total heat corresponding to this superheat, can be obtained at any particular pressure lower than the initial pressure of the steam, and hence the mean specific heat over that range of superheat, and also the manner in which it varies—if the law be known for various initial pressures—may be calculated. This is, of course, assuming that Regnault's tables of saturated steam are accurate.

Until the throttling experiments were concluded, no doubt was entertained on this point, but it was then seen that a small deviation from the straight line law laid down by Regnault, connecting total heat and temperature of saturated steam, would have a considerable effect on the calculated specific heat of superheated steam, and the author is now convinced that Regnault's tables are not sufficiently accurate to enable the specific heat to be obtained by this method with any degree of accuracy. In the meantime, however, as Regnault's tables are the only ones available for this purpose, they have been used in the calculations connected with the wire-drawing experiments, so that the final conclusions from these experiments respecting the value

of the specific heat of superheated steam must await the correction of these tables.

THE APPARATUS DESCRIBED.

The principal piece of apparatus used in the author's experiments was virtually a form of throttling calorimeter, specially designed, and gradually improved to avoid, as far as possible, errors due to conduction and radiation, and to reduce corrections dependent upon the kinetic energy of the steam. After a series of small improvements, the apparatus finally assumed the form shown in part section in fig. 1.

The steam was taken direct from the crown of a locomotive boiler—not shown in the figure—through a wheel-valve WV, to a separator, S; it was then allowed to pass through a small orifice, O, in a mica disc, thus being wire-drawn, or throttled, and consequently superheated. This disc was held down on the top of the separator by a flange and studs, the steam joint being made by placing an asbestos washer on each side of the mica disc; these washers, which only needed a small inside diameter, also materially assisted the mica in the prevention of conduction of heat from the high-pressure steam to the cooler wire-drawn steam.

The now superheated steam coming from the orifice, immediately entered a glass tube, *gt*, and was caused to pass through several layers of fine copper gauze, whose object it was to destroy all eddies in the steam, and convert their kinetic energy into heat energy.

Directly after leaving the gauze, the steam came into contact with a thermometer pocket, *p'*, in which was a thermometer for taking the temperature, t_1' , the pocket being concentric

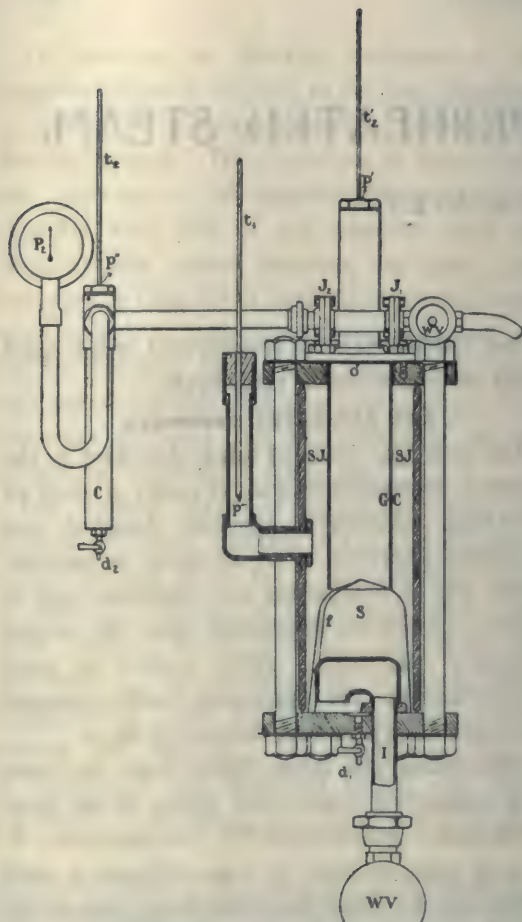


FIG. 1. GENERAL FORM OF APPARATUS.

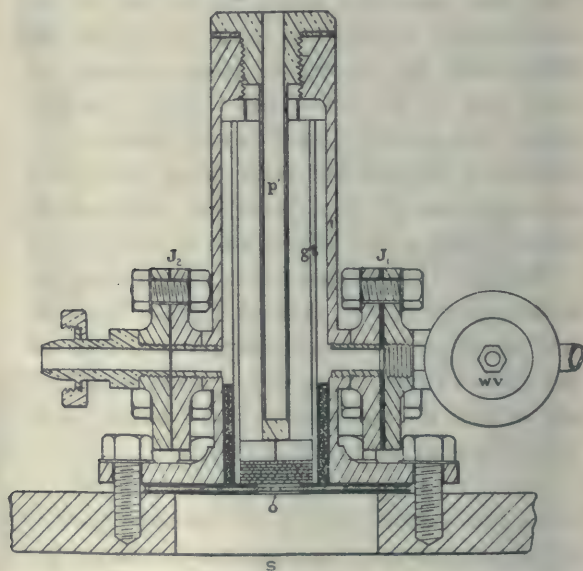


FIG. 2. A SECTION VIEW OF THE THROTTLING CALORIMETER.

with, and inside of, the glass tube; after traversing the length of this tube, the steam passed down an annular space outside it—thus forming, so to speak, its own jacket—and was then allowed to escape into the air through a small wheel-valve, *wv*, which served to regulate the pressure of the superheated steam.

PRESSURE READING OF SUPERHEATED STEAM.

The pressure reading of the superheated steam was obtained during the more recent experiments in the following manner: A passage from the side of the apparatus opposite the exhaust valve, *wv*, led through a heat-insulating joint, *J*₂, which is shown in fig. 1, along an unlagged iron tube about 20 in. in length, to a small chamber, *C*, containing another thermometer pocket, *p*". In this chamber the steam was allowed to become saturated—a process which never presented any difficulty—and the water formed was drained out by a cock, *d*₂, at the bottom, a small quantity of steam was allowed to blow through this drain-cock with the water, to ensure that water was not collecting about the thermometer pocket; the temperature, *t*₂, was taken there, and the pressure obtained from Regnault's tables. The flow of steam along the passage was so slight that no appreciable drop in pressure could be attributed to it.

The method of conducting the experiments was as follows: The boiler pressure was brought to some predetermined value, and maintained constant throughout a complete experiment by continual readings of the temperature of the boiler steam, the slightest observable tendency to change being checked by slight movements of the fire-door or dampers. Steam was then allowed to blow through the apparatus, the separator inlet valve being maintained full open during each experiment, the drain-cocks were opened by a suitable amount, and a few minutes allowed to elapse for the thermometer readings to become settled. As they approached this stage, and for a few minutes afterwards, readings of all three

thermometers were taken at intervals of a minute or two. If the temperatures were subject to slight fluctuations, which was often the case, a larger number of readings was taken and the average obtained.

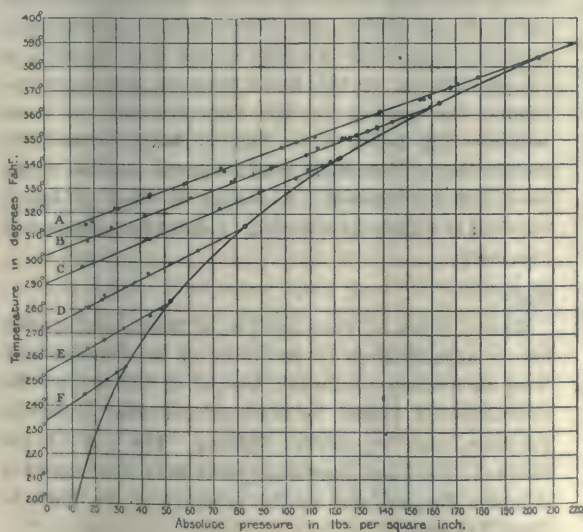
REGNAULT'S TABLES QUESTIONED.

By repeating the experiments with various boiler pressures, a series of "cooling curves" or "constant total heat curves" graphically representing the law sought, was obtained.

The apparatus having been perfected as far as possible, a complete series of experiments was carried out, the corrected results of which are given in Table I. The cooling curves obtained by plotting these results are shown in the diagram at foot of column.

On examination of this set of curves it will be seen that they are practically straight lines, not quite parallel, but becoming slightly more horizontal with higher initial pressures.

The apparent rapid increase of specific heat with temperature to values far beyond any obtained by any other experiments, led the writer to suspect the accuracy of Regnault's tables, and caused him to return to the direct heating method in the hope, also, of getting results for higher temperatures than were possible by the throttling experiments.



The apparatus was altered in order to fit the new experiments.

Table IV. gives the data obtained in a few characteristic experiments, and the resulting value of the specific heat thus obtained.

The pressure of the wire-drawn steam was raised step by step by slightly closing the exhaust

Curve.	Pressure on boiler gauge.	Temperatures of steam.			Pressure from Regnault's tables. P_r	Diameter of orifice in inches.
		Before expansion. t_1	After expansion. t_2	Re-saturated. t_s		
A	191	383.5	321.4	280.9	30.3	3/64
			316.6	224.4	18.7	
			328.8	272.8	43.9	
			332.1	290.8	58.4	
			337.8	307.4	75.0	
			351.3	336.5	96.5	
			360.5	351.7	111.9	
			367.0	361.8	137.9	
A	191	383.5	315.5	214.9	15.6	3/64
			321.6	248.0	28.8	
			327.2	273.0	44.0	
			332.8	292.1	69.6	
			338.3	306.3	73.8	
			349.3	330.6	104.2	
			361.2	352.8	138.3	
			366.8	361.0	155.3	
A	190	383.5	307.9	382.8	159.0	1/16
			371.3	367.3	167.9	
			372.4	369.1	171.7	
			375.1	372.4	178.8	
			308.5	220.6	17.4	
			313.7	246.3	27.5	
			318.9	270.1	42.0	
			326.1	294.1	61.5	
B	160	365.0	332.6	209.9	77.8	3/64
			338.4	223.1	94.0	
			343.6	233.5	108.4	
			350.8	245.2	126.7	
			333.6	311.2	79.3	
			346.5	337.2	113.6	
			350.3	343.4	123.8	
			358.8	349.4	133.9	
B	160	365.0	355.1	351.3	137.2	3/64
			350.3	343.9	124.6	
			351.9	346.5	128.9	
			353.7	349.3	133.7	
			354.9	351.3	137.2	
			357.4	354.9	143.7	
			363.7	363.7	159.3	
C	109	342.0	297.0	212.0	14.7	1/16
			321.8	306.1	73.6	
			328.1	318.4	89.2	
			334.5	330.4	104.2	
			337.1	334.2	109.5	
			339.3	338.0	115.2	
			340.9	340.6	116.3	
			369.0	372.8	43.9	
D	71	315.1	281.9	215.4	15.7	1/16
			285.9	334.1	22.4	
			291.5	357.0	33.7	
			292.1	258.3	34.5	
			296.4	271.2	42.3	
			301.6	286.0	54.2	
			305.8	296.2	63.5	
			310.4	306.5	74.0	
E	40	284.1	312.8	311.4	79.6	3/32
			263.2	218.1	16.6	
			267.4	237.9	24.1	
			272.0	255.4	32.8	
			278.7	272.9	44.0	
			280.2	279.5	46.9	
			284.0	284.0	52.6	
			244.6	214.9	15.6	
F	20	256.5	260.5	339.7	24.9	3/32
			253.5	349.3	39.5	
			256.6	355.5	33.4	

TABLE I. CORRECTED RESULTS OF COMPLETE SERIES OF EXPERIMENTS.

Mean initial temperature.	Mean final temperature.	Rise in ° C.	Watts.	Watts for rise of—	Grammes of steam per min.	K_p .
112.8	144.2	31.4	34.6	(31°)	20.1	0.473
111.6	142.4	30.8	88.1	83.7	67.2	
111.7	142.6	30.9	95.1	95.4	79.1	
117.5	182.6	65.1	76.6	(65°)	22.9	0.452
117.6	182.7	65.1	160.4	160.2	64.7	
117.4	183.1	65.7	211.5	202.1	86.0	
102.7	196.3	93.6	106.5	(93°)	26.4	0.458
102.7	197.8	95.1	109.6	108.1	26.6	
102.7	198.6	95.9	163.5	162.1	40.9	
102.6	199.5	96.9	200.5	196.5	65.1	
102.7	199.3	93.6	200.5	203.5	57.1	
102.7	200.7	98.0	235.0	227.8	65.4	
173.0	296.6	119.6	134.3	(120°)	13.0	0.459
172.9	293.7	120.8	297.0	285.5	47.3	
172.5	297.0	124.5	372.0	355.2	68.3	

TABLE 2. DATA ON WHICH ESTIMATE OF MEAN SPECIFIC HEAT OF SUPERHEATED STEAM IS BASED.

valve, and the process of taking temperature readings was repeated at each step; by plotting the results with pressures as abscissæ and temperatures of the superheated steam as ordinates, a "cooling curve" could be drawn over which the total heat remained constant except for the very slight necessary corrections.

RESULTS OF EXPERIMENTS.

Numerous experiments were carried out, but the results varied too much amongst themselves to allow any conclusions to be drawn as to the manner in which the specific heat may vary with pressure or temperature, except that any such variation must be small, and by no means of the order indicated by the results of the throttling experiments based on Regnault's tables. The mean of all the results gave K_p , the mean specific heat of superheated steam at constant pressure = 0.43, but the author believes that the value of 0.46 is more accurate, this being the average of the values obtained in the most satisfactory experiments.

The experiments were all carried out in the Engineering Laboratory of Cambridge University.

Abstract of a Communication to the Royal Society by Professor Ewing, F.R.S.

Openings for Trade Abroad.

France.

A recent British consular report from Bordeaux states that land has been acquired for new wet docks, which it is hoped will be begun next year. If work progresses satisfactorily a little over 1 kilom. of new quays will be available in 1908, the maximum length of quays when finished being nearly 2,190 yards. These new docks are to be deeper than the existing lock of entrance by 1 metre, but in order to utilise their extra depth a new lock must eventually be constructed.

In another part of the same report the Consul remarks that the drill and machine tools introduced into Bordeaux by British firms last year are competing favourably with similar articles of foreign manufacture. There is an opening for electrically-driven machines, but it is essential to send out experts to study local requirements.

Belgium.

The municipal authorities of the city of Antwerp require tenders for the supply of a heating apparatus in a scholastic institution in the Rue Louise. Adjudications will take place on June 20th, and a deposit of £20 will be required to qualify any tender, which should be addressed to the Burgomaster, Hotel de Ville, Antwerp.

Switzerland.

There is an increasing demand for electrical appliances, more especially in hotels. In districts where electric power is available, hotel proprietors are beginning to make use of it for domestic purposes. Electric ventilators are very largely used, as well as electric lifts for passengers and goods.

Brazil.

Tenders, which will be opened on 30th June, at the Directorate General of Works and Ways of Communication, Rio de Janeiro, are invited for the construction of a railway from Santo Antonio, on the River Madeira, to Guajará Mirim, on the River Mamoré, together with a branch line passing through Villa Murinho, or some neighbouring point, in the State of Matto Grosso, and terminating at Villa Bella, situated at the junction of the Beni and the Mamoré. A deposit of about £2,250 is required to qualify any tender. Local representation is necessary.

Italy.

Messrs. Brioschi, Finzi and Co., of Milan, have applied for an appropriation of 700 litres of water per second, from the Sermenza waterfall, District of Rimasco, for the production of power for traction and other industrial purposes, and for electric lighting. The cost of the hydraulic plant and generating machinery is estimated at about £64,000, and of the erection of the lines at about £58,000.

LAUNCHES AND TRIAL TRIPS.

THE *Kut Sang*, a mail steamer 400 ft. in length with 51 ft. beam, built by Messrs. Swan, Hunter, and Wigham Richardson, Ltd., for the Indo-China Steam Navigation Company, Ltd., was recently taken to sea to undergo her trials. The vessel, which is to run in the Hong Kong and Calcutta trade, has most comfortable accommodation for European passengers on the bridge deck, first-class Chinese under the bridge deck, and second-class Chinese in the poop. The main engines, which are of quadruple-expansion type balanced on the Yarrow, Schlick and Tweedy system have also been constructed by the same firm. A complete and modern instalment of auxiliary machinery has been fitted for readily handling the ship and her cargo. The speed attained on the trial trip averaged over 13½ knots, and the trial proved in all respects satisfactory. Amongst those present were Mr. H. Beazley, director of the owners' company, and Mr. T. P. Murdoch, their superintendent engineer. The *Kut Sang* (which means "Lucky Increase") sailed for Cardiff after the trial to load before proceeding to the East.

There was launched from the shipyard of Messrs. Cochrane and Sons, shipbuilders, Selby, on the 6th inst., the steel-screw trawler *Orpheus*, the principal dimensions being 120 ft. by 21 ft. 6 in. by 11 ft. 6 in. depth of hold. The vessel has been built to the order of Messrs. E. Bacon and Co., of Grimsby, and will be fitted with powerful triple-expansion engines by Messrs. Amos and Smith of Hull. She has all the latest improvements for fishing purposes. As the vessel left the ways she was christened by Miss Cochrane of Hull.

On the 6th inst., Messrs. Workman, Clark and Co., Ltd., Belfast, launched from their south yard a new vessel built for Messrs. Elder, Dempster and Co., of Liverpool. The *Patani* is intended for the West African coast trade, and is 384 ft. long, with a gross tonnage of over 3,600. The cargo space is divided into four spacious holds by steel watertight bulkheads extending to the upper deck, the decks being supported by fore and aft girders with built columns. These holds are comparatively free of obstruction, and are capable of receiving large and bulky cargo. Each of the four hatches will be equipped with the necessary steam winches and derricks required for rapid loading and discharging. A number of staterooms for passengers will be fitted at the fore end of the bridge house with

a dining saloon in the centre of the vessel. After a successful launch the *Patani* was towed to the crane to receive machinery and boilers. These have been built by Messrs. Workman, Clark and Co., Ltd., and consist of a set of triple expansion-engines, with three steel multitubular boilers fitted with Howden's system of forced draught.

On the 6th inst. Messrs. R. Craggs and Sons, Ltd., launched from their Tees dockyard, Middlesbrough, a steel cargo steamer 340 ft. 3 in. long, 47 ft. beam, 24 ft. 4 in. depth moulded. The vessel is being built under special survey to take the highest class under Lloyd's three-deck rule with one deck laid, having poop, long bridge, and forecastle. Cellular double bottom is fitted throughout for water ballast which is also carried in extra large after peak tank. Powerful steam winches are provided of the most approved type driven from a specially large Meredith type donkey boiler. The machinery will be fitted by Messrs. Blair and Co., Ltd., of Stockton-on-Tees. The engines will have cylinders 23½ in., 39 in., 64 in., by 42 in. stroke, steam being supplied by two large single-ended boilers working at 160 lb. pressure. The vessel had been built to the order of the Constantine and Pickering Steamship Company, of Middlesbrough, and on leaving the ways was named *Kirnwood* by Miss Ella Constantine, of Cardiff. The specification has been supervised and the construction of both hull and machinery has been superintended by Mr. William Constantine.

There was launched from the Wallsend Shipbuilding Yard of Messrs. Swan, Hunter and Wigham Richardson, Ltd., on the 7th inst., a steel-screw steamer, which has been built to the order of the Chinese Engineering and Mining Company, Ltd. The vessel is of the following leading dimensions, length over all 324 ft., beam extreme 44 ft. 3 in., and depth moulded 23 ft. She has been designed for the owners' special trade on the China Coast and is being built to Lloyd's highest class spar-deck rule. Accommodation has been provided for a few first-class passengers amidships and a large number of Chinese passengers aft. The vessel has been designed to carry a large dead-weight cargo on a draught of 18 ft. 9 in., and to steam about 12½ knots at this draught. The engines are being constructed by the Wallsend Slipway and Engineering Company, Ltd., and consist of a set of triple-expansion engines, having cylinders 25½ in.

41½ in., 68 in. by 45 in. stroke, steam being supplied by two large single-ended boilers, working at 180 lb. pressure, and fitted with Howden's system of forced draught. On leaving the ways the vessel was named the *Kaiping* by Mrs. MacFarlane, wife of Captain Macfarlane, who, in conjunction with Mr. Joseph Blackett, superintendent engineer for the owners, have supervised the building of the vessel.

On the 6th inst. Messrs. Irvines Shipbuilding and Dry Docks Company, Ltd., West Hartlepool, launched from their shipyard a steel-screw steamer, built to the order of Mr. R. Hardy, West Hartlepool. She is of the following dimensions: 351 ft. by 48 ft. by 23 ft. 2 in. The vessel is built to Lloyd's highest Class under special survey, and is of the single-deck type, having poop, bridge and top-gallant fore-castle. A double bottom is fitted throughout on the cellular principle, and the fore and after peak tanks are arranged as trimming tanks. She is constructed with bulb angle frames, web frames and longitudinal stringers, giving clear holds for the storing of bulky cargoes. Six water-tight bulkheads divide the holds into seven water-tight compartments, and wood grain divisions are fitted in the holds. She also has extra-large cargo hatches, with double derricks, six powerful steam winches which are supplied with steam from a marine type multitubular donkey boiler, and is replete with all the latest improvements for rapid loading and discharging. A powerful quick warping steam windlass is fitted forward for the working of the cables, and steam-steering gear is fitted amidships with hand screw gear aft. Engines of the triple-expansion type are being supplied and fitted by Messrs. Blair and Co., Ltd., Stockton, having cylinders 23½ in., 39 in. and 64 in. by 42 in. stroke, with two large S.E. boilers, 180 lb. pressure. The vessel has been supervised during construction on behalf of the owner by Mr. D. Ross.

Messrs. Wm. Simons and Co., Ltd., Renfrew, launched on the 6th inst. with engines and boilers on board complete, a twin-screw suction pump dredger, which they have constructed for the Government of Natal to the order of the Agent-General, this being the largest dredger they have yet constructed. The dimensions are as follows: length, 301 ft., breadth, 47 ft., depth, 21 ft. 3 in. The hopper has a capacity for 3,000 tons of dredging, and is fitted with the builders' patent sand trapping arrangement. The centrifugal suction pumps, two in number, are duplicates of the pumps supplied and fitted by Messrs. Simons to the Natal Government dredger *Nautilus*, which vessel removed in the month of March of the present year, at a cost of less than one halfpenny per ton for working

expenses, fully half-a-million tons of sand. It has repeatedly filled its hopper, containing 2,500 tons, in fifteen minutes, being at the rate of 10,000 tons of sand per hour. The large main suction pipe of the new dredger, capable of dredging to a depth of 46 ft., is 44 in. internal diameter, and is fitted in a central well at the fore part of the ship and controlled by powerful hydraulic gear fitted on the upper deck. This pipe is connected to both pumps and is fitted with an arrangement of flexible joints for preventing damage when the vessel is working on the bar at Durban, which is very much exposed to heavy seas. The lower end of the suction pipe is so arranged that the vessel can plunge about in a 25 ft. radius without disturbing the nozzle on the ground. The vessel is propelled by two sets of triple-expansion engines, fitted with all the most up-to-date appliances for efficiency and economy.

Steam is supplied from three steel boilers of the Scotch type for 180 lb. water-power. The boilers are fitted with an efficient arrangement for equalising the temperature—a matter of great importance in this class of boiler—and are designed to give a high evaporative efficiency. Each suction pump is driven by one set of triple-expansion surface-condensing marine engines. An auxiliary condenser and separate combined air and circulating pump are provided for dealing with the exhaust steam from the auxiliary engines. The combined power of the propelling, pumping and auxiliary engines on board is about 4,000 i.h.p.

As she left the ways the vessel was named the *Cetus*, by Lady Arbuckle, wife of the Agent-General for Natal. In addition to the *Cetus*, Messrs. Simons have also supplied the Natal Government this year with two pontoon reclamation dredgers, one of them being provided with special cutter gear fitted to lower end of suction pipe for disintegrating hard material. In all, the builders have supplied sixteen dredging vessels, practically the whole of the dredging fleet employed at Durban for the removal of the bar and improvements of the harbour works there.

The *Cetus* and the reclamation dredgers referred to were constructed from the builders' designs under the direction of Mr. H. G. Humby, M.Inst.C.E., consulting engineer in London to the Natal Government, assisted by Mr. Wm. Inglis, of the Durban Harbour Works, resident inspector. It should be added that the *Cetus* was completed several weeks ahead of the contract date for delivery. The operations of these dredgers at Durban have made it possible for vessels of the deepest draft to cross the bar and go alongside the wharves there.

OUR WEEKLY BIOGRAPHY.

MR. EDGAR WORTHINGTON, B.Sc., M.Inst.C.E., M.I.Mech.E.

MR. EDGAR WORTHINGTON, secretary of the Institution of Mechanical Engineers, was born at Lancaster in 1856. Upon the completion of his school training in his native town he obtained the mathematical junior Dalton entrance scholarship at Owens College, and matriculated at the University of London. Having specialised in science he obtained the grade of Associate of the College in 1875, and then underwent a workshop pupilage in the various departments of the Crewe Works of the London and North-Western Railway. While with this company he gained valuable experience at the Holyhead Docks, and also at the Colwich locomotive shed, where he was responsible for the erection of all the buildings and machinery. He was subsequently appointed assistant manager of the locomotive workshops at Crewe. He remained in this position for three years during which time many improvements were introduced by his chief, Mr. F. W. Webb, including the development of the three-cylinder compound locomotive. From 1881 to 1883 Mr. Worthington resided in America, where he was engaged in the Baldwin Locomotive Works, Philadelphia, the Pennsylvania Railroad Works at Altoona, and subsequently he gained further experience as a leading draughtsman in the Rhode Island Locomotive Works. While in New York he was engaged under the late Mr. Howard Fry in

designing a complete set of rolling stock for the New York West Shore and Buffalo Railway. At this period he was a contributor to the technical press of the United States.

In 1885 he was appointed chief assistant engineer to Messrs. Beyer, Peacock and Co.'s Gorton Foundry,

Manchester, where he spent the next twelve years in designing locomotives and in workshop improvements. On behalf of this firm from time to time he visited most of the European countries and also Egypt, India, Australia, China and Japan, and he again visited the United States in 1893, where he spent several months examining and reporting on steel works, and machine tools, including the mechanical exhibits at the Chicago Exhibition. Mr. Worthington terminated his engagement with this company in 1897, when he was elected secretary of the Institution of Mechanical Engineers.

Mr. Worthington is a member of the Institution of Civil Engineers, and an Associate of the



MR. EDGAR WORTHINGTON B.Sc., M.INST.C.E.,
M.I.MECH.E.

Owens College, Manchester. His name frequently figures among the transactions of the technical societies. In 1889 his paper on "The Compound Principle applied to Locomotives," read before the Institution of Civil Engineers, was awarded the George Stephenson gold medal and the Telford premium.

A NEW ENGRAVING AND ROUTING MACHINE.

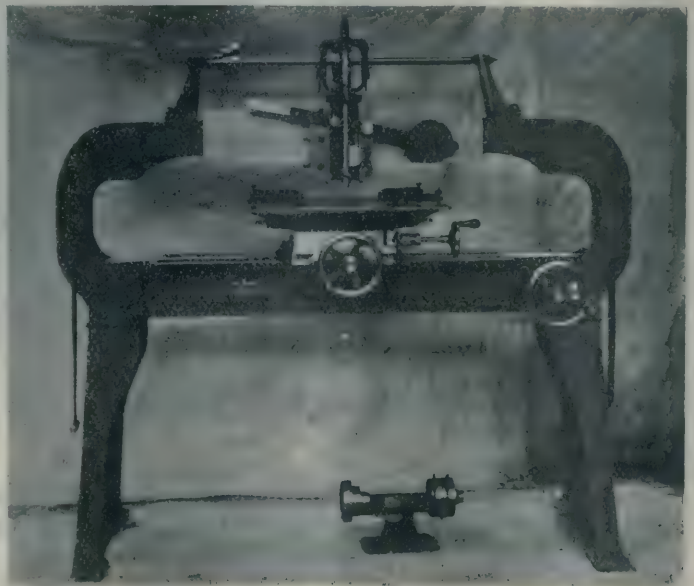
BY G. BIRCH AND CO., MANCHESTER.

THE perfection which the engraver has been able to attain in modern illustrative work owes not a little to the router, for cutting out patches of superfluous metal. The constantly increasing demands of the engraver for higher speeds in order to negotiate this most intricate work have called for the exercise of considerable engineering skill. Several firms in this country have long given special attention to the matter. The class of engraving and routing machine illustrated herewith has been made by Messrs. G. Birch and Co., of Manchester, for many years, but this particular machine is of larger size, embodying all the latest improvements for rapid, accurate, and economic work. It is of powerful and rigid construction. The standards which carry the bed and top slide are cast in one piece, all four pieces being heavy castings, to prevent any vibration at the high speeds necessary.

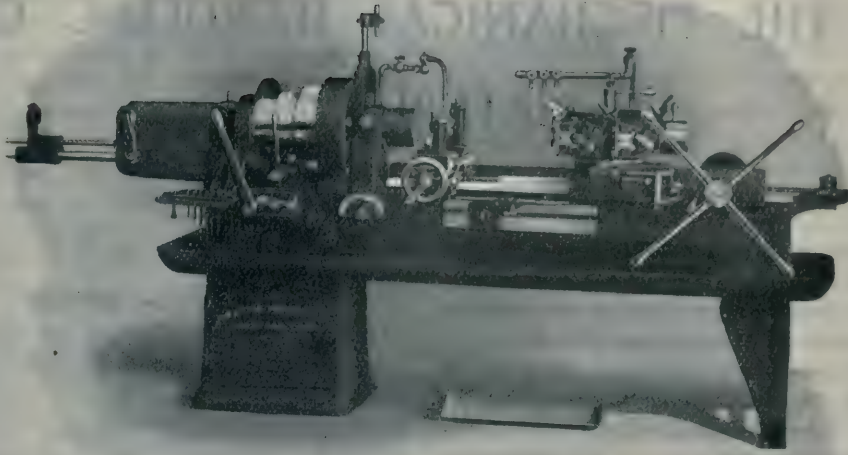
The cutter spindle is of tool steel, hardened, and runs in hardened steel bearings, all being ground dead true after hardening. The bearings are taper, all wear in both bearings being taken up by tightening the lock-nuts above the top bearing, and a hardened steel thrust-pin is provided to take the end thrust of cutters. The cutter head can be fastened anywhere along the top slide, the cutter slide and spindle being balanced, so that the cutter spindle always returns to the top when released, but a locking screw is provided to lock it at any height when necessary. Stops are fitted for adjusting the depth of cut. The back-shaft that drives the cutter spindle runs on hardened steel

centre points and carries a cone-pulley, giving three rates of speed to the cutter spindle.

The table has longitudinal transverse and circular movements, and is fitted with two sliding jaws, with independent screw adjustment for holding the work, and has a semi-circular recess in the centre for holding circular work, such as bookbinders' rolls, etc., while the edges are being engraved, the recess being covered by a plate when not in use. The screws to slides have gun-metal nuts, with adjustment for wear, so that all back-lash can be taken out. A special table is fitted on top of the ordinary table for use when doing large work, and four cramps for holding the work are supplied, as shown. A leather strip is fitted to the gantry of bed which protects the longitudinal screw from dust and chips. The traverse screw, and the worm and wheel, for circular motion are completely enclosed so that no dirt



IMPROVED ENGRAVING AND ROUTING MACHINE.



NEW MODEL "PRATT AND WHITNEY" 2-IN. BY 25-IN. TURRET LATHE.

can get into them. A countershaft and set of working screw-keys is supplied with each machine. The leading dimensions of the machine are: distance between standards, 5 ft. 6 in.; length of bed, 54 in.; length of top slide, 36 in.; size of ordinary table, 17 in. by 15 in.; size of special table, 24 in. by 24 in.; longitudinal

traverse, 2 ft. 6 in.; transverse traverse, 17 in.; maximum height from table to lower end of cutter spindle, 4 in.; size of pulleys on countershaft, 5 in. by $1\frac{1}{2}$ in.; speed of pulleys on countershaft, 220 revolutions per minute; floor space, 6 ft. by 3 ft.; approximate weight, net, 15 cwt.

NEW MODEL 2-in. by 26-in. TURRET LATHE. BY THE NILES-BEMENT-POND COMPANY.

THE illustration on this page shows the "Pratt and Whitney" 2-in. by 26-in. Turret Lathe (new model), one of a range of five sizes. The bed, pan and headstock are made in a single casting to secure great rigidity. The construction of the spindle is that adopted for precision tools; the spindle, nose-piece and closer are ground at points of adjustment, and improved rod feed is provided. The turret is designed to give rigid support to the tools and retain its alignment under long and severe use. It will be seen by the illustration that the turret stops are in a convenient position on the front of bed,

and that the stop mechanism is of a simple and reliable type. The provision of an independent cross slide with back and front tool posts enables the operator to do turning and facing by means of the cross side tools simultaneously with boring or facing with the turret tools. In these machines great accuracy is secured by careful construction, and we are assured that the work turned out by them has proved eminently satisfactory. The New Model Turret Lathes are supplied with large or small equipments, and are thoroughly adapted to the use of high-speed steels.

“THE MECHANICAL HANDLING OF MATERIAL.”

THIS treatise is in many aspects unique, for Mr. Zimmer is emphatically not a bookmaker and, indeed we do not remember having seen his name on a title page before. When he first began to interest himself in the mechanical handling of material, his appearance in the arena of technical authorship was probably the last thought which entered his mind. The book has really grown out of the professional career of the author during the past twenty years, and as there is no authoritative work on this important branch of engineering, Mr. Zimmer has done good service in bringing within the covers of a single volume a vast amount of information, embodying not only his own experience but that of other workers in the same field. The author will be remembered as the writer of a paper on a branch of his present subject, read before the Institution of Civil Engineers in 1903, and with the issue of this volume he may be fairly said to have made the subject his own.

In the opening chapters of the book the continuous handling of material is treated at considerable length. It is a subject which engineers would classify under three heads: Appliances for lifting in a vertical direction or from one level to another, as in the case of elevators; appliances for moving material in a horizontal direction, the conveyor system; and appliances which combine elevating and conveying into one process. Elevators in a primitive form have of course been known for a very considerable period, and since their introduction have really undergone little alteration except in detail. A familiar example of the elevator is that designed for moving grain, the largest type of which in the United Kingdom, it will be remembered, is one in operation on the Manchester Ship Canal, which has a lifting capacity of 350 tons per hour. Mr. Zimmer describes cable chain elevators for handling rough and uneven material, worm elevators, automatic feeding devices for elevators, and mechanical and oscillating feeding devices, and single bucket elevators such as are used at the Liverpool Docks Granary. Furnace elevators are also discussed, among those

illustrated being that of the Carnegie Steel and Iron Company.

CONVEYOR SYSTEMS.

Conveyors are of varied types, and there are some of great antiquity, notably the archimedean screw or worm conveyor, which still do serviceable work. Worm conveyors are obviously of great service where a mixing of the material to be conveyed is desired. Band conveyors date back to 1868, and Mr. Zimmer reminds us that the power required for band conveyors for grain is less than with any other conveyor. A recent innovation in belt conveyors, that introduced by the Ridgeway Belt Conveyor Company is claimed to offer advantages over existing types, and it is stated that with this conveyor twelve railway wagons can be loaded in one hour by two men. The latest type of conveyor, the vibrating trough conveyor, is described at some length and illustrated, as is also the swinging conveyor with which the name of the author is associated. Among gravity or tilting bucket conveyors the Hunt and the Bradley are selected as representing two distinct types, while of modern continuous bucket conveyors the Bousse conveyor, designed to overcome the drawback or inability to work except in one plane is dealt with at some length. As engineers are aware it is claimed for the Bousse conveyor that it will go round any incline backwards and forwards in both planes.

In an interesting section of the book the author discusses conveyors designed for special purposes, including the Bolinder timber conveyor used at the Millwall Docks, the Muller coke conveyor, and the well-known De Brouwer conveyor, one of the most successful appliances of its kind. The Merz hot coke conveyor, which is illustrated, is to a great extent a modification of the De Brouwer, and attention is also directed to the advantages of the Uehling casting machine and conveyor in use at Millom Ironworks.

OLD AND NEW METHODS ILLUSTRATED.

Like many other forms of machinery for handling material intermittent conveyors are of ancient origin, and endless chain and rope haulage has been long in use. In fig. 1 we illustrate an early ropeway erected

“The Mechanical Handling of Material.” By George Frederick Zimmer, A.M.Inst.C.E. With numerous illustrations. Crosby, Lockwood and Son, 25s. net.

for the city of Dantzic. This was the work of a Dutch engineer, Adam Wybe of Harlingen, in 1644. The ropeway connected the city ramparts with the hill outside the town. It is a remarkable fact that although wire ropes were known to the Romans eighteen centuries ago, they were not pressed into the service of modern engineering till the nineteenth century was well advanced. The development of this system is traced by the author through its various stages, and the loading station of an Otto-Pohlig ropeway, one of the latest forms of ropeway, is illustrated in fig. 2 for the purposes of contrast. Some space is devoted to a consideration of coaling vessels at sea by specially constructed cable ways, and although portions of the apparatus are still in the experimental stage, the matter has been taken up vigorously and worked at in a manner which appears to presage ultimate success. The problem is full of interest to a maritime nation.

UNLOADING AND LOADING APPLIANCES.

An important part of the book is that devoted to unloading and loading appliances, both in relation to ships and barges and railway trucks. Appliances for

discharging ships and barges naturally divide themselves into discharging by skip and grabs, and by means of elevators and self-emptying boats. The grab dates back to 1703 and the early type was not vastly different to that in use to-day. In the chapter on elevator dischargers special attention is directed to the Derrick elevator in use at the London Docks, designed for unloading grain from the largest type of American liners, which has a capacity of 150 tons per hour. It may fairly be said that unloading by means of self-emptying boats is a form of appliance which is at present only in the initial stages of development, but some of those already in use are credited with an unloading capacity, in the case of coal, of over 200 tons per hour.

In dealing with the important question of the discharging of railway trucks, the author very properly reproached British railway companies for failing as yet to grasp its full importance, and in this journal the subject has received attention on more than one occasion. It is satisfactory, however, to know that British railway managers are at last realising the importance of reducing as much as possible, for heavy mineral traffic at all events, the dead load proportion of their rolling stock, and it is to be hoped that a large



FIG. 1. AN EARLY ROPEWAY ERECTED FOR THE CITY OF DANTZIG.



FIG. 2. LOADING STATION OF AN OTTO-POHLIG ROPEWAY.

proportion of the trucks for bulk transport of raw material will be of the self-emptying type. It should be clearly understood, however, that the use of self-unloaders can only be fully beneficial when used in conjunction with other mechanical devices and suitable terminal plant. The author directs special attention to the self-discharging iron ore wagons of the Alquife Mines and Railway Company. The ballast wagons of the Great Western Railway of the self-unloading type are illustrated, and also one in use on the London and North-Western Railway, and many will be interested in the illustrations and descriptions of the Hunt automatic railway, which, as readers will remember, is operated entirely by gravity. A special chapter is devoted to the subject of unloading by means of coal tips and is copiously illustrated, special attention being devoted to the Armstrong hydraulic tip and the electrically-driven tip at the harbour of Rotterdam.

Under the heading of miscellaneous loading and unloading devices, many ingenious systems are described. The final section of the book treats of the automatic weighing of material, the Ingrey automatic coal-weighing machine, and Avery's machine, being

specially illustrated. In this country automatic machinery has been very little used for the coaling of locomotives, but probably the efficient installations on American lines will soon be in use here. An important branch of the mechanical handling of material, and a comparatively new one, is that of coal-handling plant for gas works, power stations, etc., and in this connection the author describes and illustrates some of the latest installations of this type, notably that at the South Staffordshire Mond Gas Company's works. The final chapters are devoted to machinery for handling grain, and a typical modern granary is described in detail. There is indeed no branch of the subject left untouched by Mr. Zimmer, who has spared no pains to make his work interesting and comprehensive. The book is admirably illustrated and tolerably well indexed. The author is to be congratulated on the successful completion of a task which must have occupied a prodigious amount of time. A man does not produce more than one work of this character, and Mr. Zimmer may well be content to let his reputation as an author rest on this volume.

THE KEDABEG COPPER MINES.

BY GUSTAV KÖLLER.

THE mines of Kedabeg are situated about 60 versts to the south-west of the town of Elisabetpol and 42 versts southwards of the station Dalbar on the Trans-Caucasian Railway. The copper-ore deposits consist of a series of lenticular deposits of pyrites (up to the present time sixteen such deposits have been opened up) which rest upon an acid eruptive rock, containing 60 to 80 per cent. silica. As a rule the richer copper compounds are found concentrated under the hanging-wall, towards the footwall the copper content diminishes, and at the partings generally disappears altogether. The size of the ore pockets varies from 33 to 820 ft. in length, from $16\frac{1}{2}$ to 165 ft. in width and from $6\frac{1}{2}$ to 165 ft. in thickness.

The copper ores, especially the richer ones, occur invariably in conjunction with zinc blende. The whole ore region has been worked by a dip, this system being enforced by the nature of the ground. For the winning of the ore in the Kedabeg mines three methods of working are employed, according to the conditions obtaining. The first is the caving-in method, which is always used where the ore pocket is of considerable width.

The second method of working is the pillar and stall, with stowing. This system is employed for winning the ore where the roof consists of fairly solid rock. The third method is the pillar and stall without stowing, and this is only adopted in working small pockets with very solid hanging rock.

The coarser ores are sorted in the mine as far as the conditions permit, and they are graded a second time in heaps in front of the adit openings. From here they are conveyed to the central stock yard, near the works railway, in iron wagons with brakes, which run down an incline of 1 in 10, upon a track of $21\frac{3}{4}$ -in. gauge. The empty wagons are hauled up to the mine again by horses. The total quantity mined between 1860 and 1899 was 50,000,000 poods (about 800,000 tons), of which 29,000,000 poods were high percentage ores, and 21,000,000 were poor ores.

In order to hasten the work of deep exploration, electric rock drills of the Siemens and Halske type have latterly been introduced. To the mines are attached two smelting works, connected by means of

a narrow-gauge metre railway of a total length of 30 versts. It was constructed partly to carry the ore, but mainly for the purpose of supplying the two works with fuel.

THE FUEL PROBLEM.

For a long time the procuring of fuel was a matter of such extreme difficulty that the very existence of Kedabeg seemed to be threatened. As soon as the Trans-Caucasian Railway was opened between Tiflis and Baku, petroleum became available. At first this was only used to replace wood in the firing of steam boilers, but afterwards it came more and more into use for metallurgical operations on a large scale, until at the present time the annual consumption has risen to about 1,200,000 poods. A pipe line of 29 miles in length has been constructed from Dalbar station to Kedabeg, and been found most efficient.

Consequent upon the increased output, the plant has, of course, also been considerably extended and modernised, and at the present time the two works comprise quite a large number of furnaces and other metallurgical apparatus and technical appliances of every kind.

The aim of the first smelting process—the ore is smelted in reverberatory furnaces—is the formation of a regulus as rich as possible, but without too great a loss of copper by slagging. Experience at Kedabeg has shown that if the de-sulphurisation of the ore is carried too far (to 5 or 6 per cent.), the re-actions between the oxides and the metallic sulphides do not by any means take place with the desired regularity, but very often are accompanied by the separating out of objectionable compounds, difficult to define exactly, but very rich in iron, which adhere to the hearth and interrupt the smelting process. These can be neutralised either by increasing the temperature or by increasing the addition of quartz or other acid additions.

Both these remedies cause an increased consumption in fuel, on which account a too thorough roasting of the ore is to be avoided. It is not, however, always easy to control the degree to which roasting should be carried, and therefore the various qualities of ore are graded, in order to obtain the best possible conditions for smelting. If in spite of this precaution the troublesome deposits still form, and then sulphides in the

form of raw ore very high in copper or unroasted regulus are added, but this is rarely necessary.

By these means, regulus is obtained containing 25 to 30 per cent of copper, and slag with 0.4 to 0.8 per cent.

THE FURNACES DESCRIBED.

The matte, after being almost entirely de-sulphurised, is reduced in shaft furnaces to black copper, a small quantity of matte being formed which is rich in copper, but contains little precious metal. About two-thirds of the product is smelted at the Kalakent works, where cheap water power is available, and only the remaining third is worked up at Kedabeg. The furnaces used for this purpose are trapezoidal in section, the width at the back being 0.9 m. and in front 0.6 m. The height from the hearth to the throat is 3.5 m. They are run either with charcoal or with anthracite, being fitted in the former case with simple tuyeres and in the latter with water-cooled tuyeres, which do not exceed three in number. All the furnaces are provided with a crucible, and the black copper and the small quantity of high-grade matte are run off once in every 24 hours through a tapping hole in front. The black copper is lifted off in discs (rosettes), and the slag flows off continuously into the casting pit. This method of working was adopted for the reason that it offered the best means for the prevention of theft.

The copper oxide is thus reduced to metallic copper, and at the same time the peroxide of iron is transformed into protoxide of iron, and the latter is slagged off with acid fluxes. Any sulphate of copper which may have remained in the roasted matte is re-converted into oxide and afterwards is likewise reduced to copper. The sulphide of iron still present prevents the slag carrying off too much copper in the form of a silicate by transforming it to silicate of iron and cuprous sulphide, which latter, along with the other sulphides, forms a high-grade matte. It is endeavoured to conduct the process in such a manner that the quantity of matte formed shall never exceed 4 per cent. This matte is almost entirely free from gold and is worked up together with the regulus.

The most effective additions for the slagging of the iron are acid slags, but if these are not available, then the silicious fluxes already referred to in connection with the smelting of the ores, and which occur in abundance in the neighbourhood, are very suitable. Of course all the slags resulting from the refining furnaces are worked over again in the blast furnaces in order to clean them, and to assist in the regular working of the furnaces. The furnace charges are generally composed of 18,000 lb. of roasted matte, 5,400 lb. of returned blast furnace slag, 1,800 lb. to 3,600 lb. of

reverberatory furnace slag, 2,160 lb. to 3,600 lb. of silicious flux, and lastly the slag from the refining processes when available. By this means a slag of the following composition is produced :—

Si O ₂	Fe O	Ca O	Al ₂ O ₃	Mg O	Cu ₂ O	Zn O	S	As(Sb)	3aSO
22.80	60.00	1.34	3.20	1.49	0.95	4.81	1.50	0.20	3.30

It will be seen that the zinc and the sulphate of barium are again present in considerable quantities. The greater portion of this slag is utilised as ballast for the Kedabeg railway, and for the macadamising of roads, the remainder being used again in the smelting process.

The resulting product is black copper, with the following average composition :—

Cu.	Fe.	Zn.	Ni. & Co.	As. & Sn.	Pb.	Sb.	Bi.	Ag.	Au.
88.03	2.3	1.2	0.05	1.5-2	0.05-0.10	trace	trace	0.06-0.08	0.0049

The high grade matte which forms contains 50 to 60 per cent. of copper.

At both works refined copper is produced, and not only the whole of the crude copper, but also all the precipitate containing over 55 per cent. copper are subjected to the refining process. The refining furnace can treat 14,400 lb. in twenty-four hours, and the process does not differ essentially from that practised in Western Europe.

Recovery of copper by the wet method is also employed at Kedabeg for lean ores of not more than 2 per cent. and not exceeding 3.5 per cent. of copper, which it would not pay to smelt.

ELECTROLYTIC INSTALLATION.

There is also an installation for the electrolytic process, accompanied by recovery of the precious metals. The plant now consists of 102 electric baths, which are supplied with current from a shunt-wound dynamo, generating 700 amperes at 35 volts.

The current density does not exceed 25 or 30 amp. per sq. m. of the cathode surface, the electric-motive force across the baths being 0.18 to 0.25 volt. The current efficiency has been found to amount to 99 per cent. The electrolyte is maintained at 75 grm. free H₂SO₄ per litre and the copper at 35 grm. per litre. The purification of the electrolyte proceeds along orthodox lines by saturating with copper from calcined matte filtration through lean ore, evaporating with excess of anode scrap aided by air blows. The excess of copper brought into the liquor is crystallised out after evaporation. The finished electrolytic copper has a degree of purity of at least 99.9 per cent., the average of the analysis giving 99.93 per cent. The weight of the finished plates is about 8 to 9 poods.

The slimes are collected from the baths towards the end of the year, and by decanting with water are freed

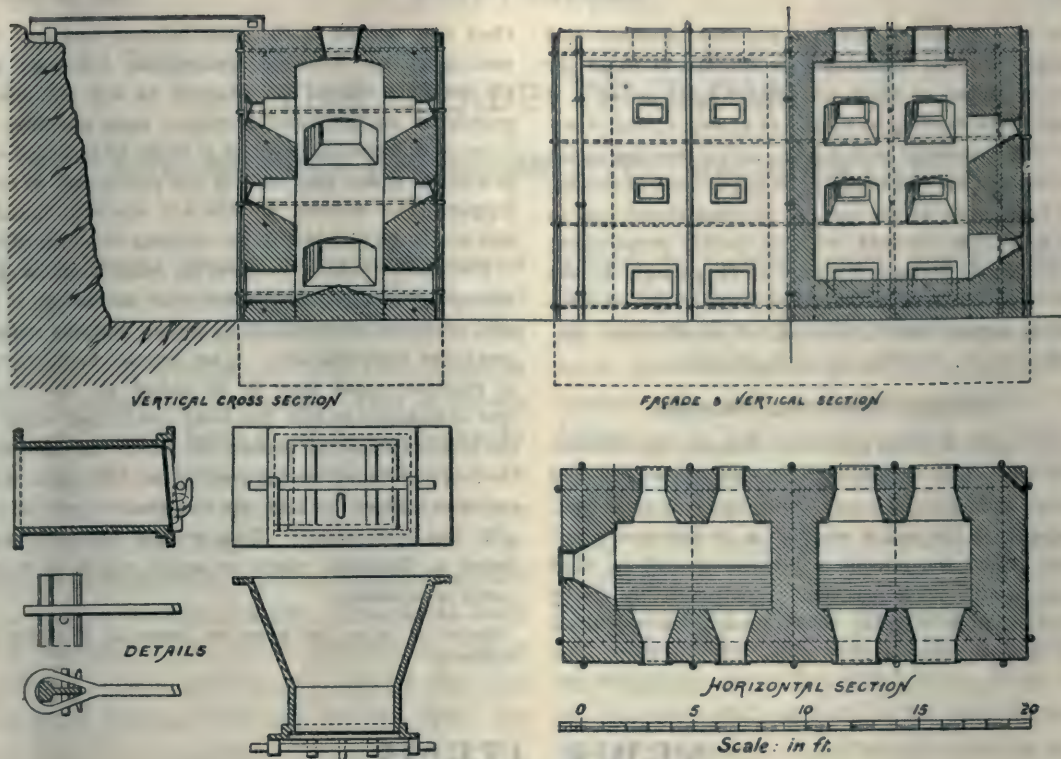


FIG. 1. DOUBLE KILNS FOR ROASTING WET ORES—KEDABEG.

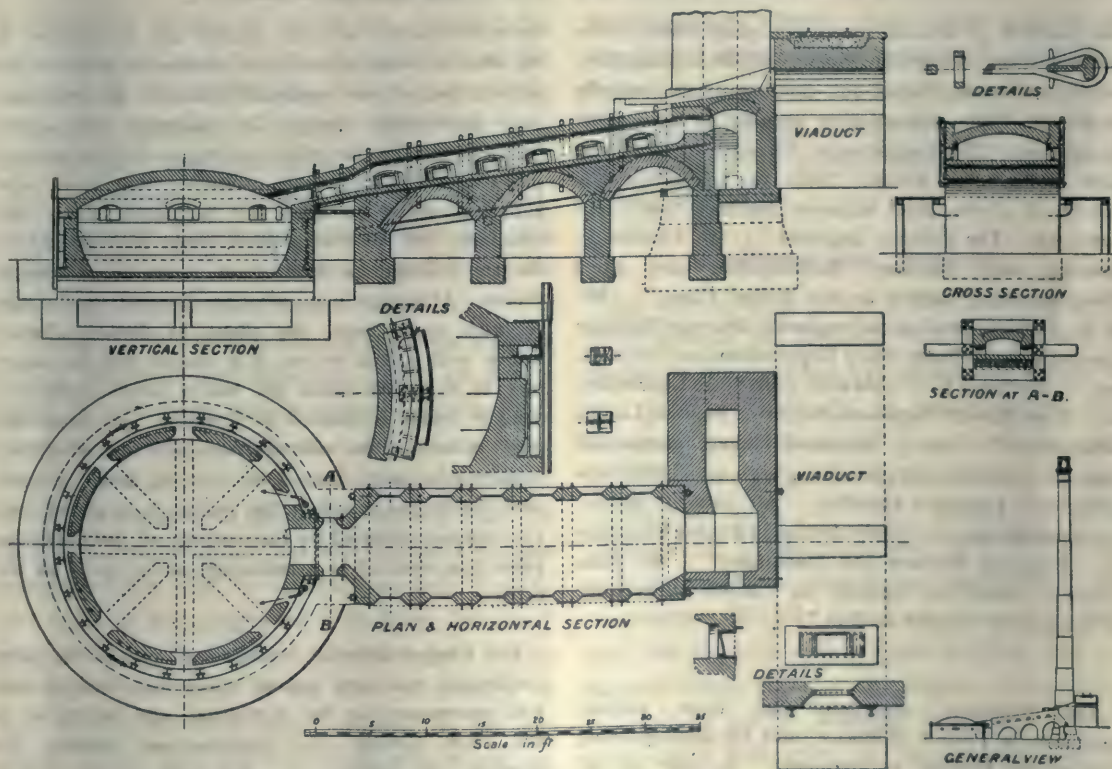


FIG. 2. REVERBERATORY CALCINERS FOR ROASTING AND SMELTING ORE—KEDABEG.

from the residual liquor and are then screened and washed. In this condition they contain 35 to 40 per cent. of copper, of which amount 25 to 30 per cent. is extracted by heating to 50 deg. or 55 deg. C. and treating with exhausted acid liquor. After washing again and drying they still retain 10 to 15 per cent. of copper, and from 25 to 30 per cent. of precious metal, and in this form they are sold, without further preparation, to the North German Refinery at Hamburg. In the year 1899 there were produced 863,136 lb. of electrolytic copper, and 3,066.12 lb. of anode slimes containing 722 lb. of silver and 55 lb. of gold.

KEDABEG SMELTING PROCESS.

The copper smelting process at Kedabeg differs somewhat from that ordinarily practised elsewhere, and modern metallurgists may be inclined to urge that, inasmuch as the ore is smelted in reverberatory furnaces, whilst the roasted regulus is treated in shaft furnaces, this must occasion a comparatively heavy loss of copper by slagging, chiefly because the reverberatory furnace process invariably yields a richer slag

than that formed in the shaft furnace working. The conditions, at Kedabeg necessitate, however, that the working should be adapted to suit the use of petroleum on the most extensive scale possible. In view of this circumstance, it is likely to be asked why petroleum is not also used in the production of crude copper. The reasons for this are also well founded, and are to be ascribed to the existing local conditions.

The concentration process in small reverberatory furnaces might be carried out with advantage if the gold could be concentrated in copper bottoms without great cost and difficulty. If an increase in the output of precious metal were to be aimed at, the process best calculated to suit the local conditions would be the Manhès Bessemer process, by which the blowing of the regulus could be interrupted at the point when sufficient copper to take up the greater part of the gold had been formed. This process might be introduced at Kalakent, where an ample supply of water-power is available.

Abstract of paper read before the Institution of Mining and Metallurgy.

NEWS ITEMS.

MR. CORWIN J. MILLER sends us a programme of the tenth meeting of the Ohio Society of Mechanical Electrical, and Steam Engineers, which was held recently at Toledo, Ohio. Papers were included by Mr. Robert A. Orin on "The Compressive Strength of Materials, with Notes on Actual Tests in Compression"; Mr. H. B. Potts, chief engineer, National Coal Company, on "The Colliery Engineer"; Mr. Charles N. Harvey, chief engineer, Muskingum Valley Steel Company on "Losses in the Power Plant"; Mr. F. W. Ballard, mechanical engineer, Sherwin-Williams Company on "Power Plant Supervision and Accounting"; Professor F. C. Caldwell, Ohio State University, on "Some Recent Improved Forms of Electric Lamps (illustrated)"; Mr. J. Rowland Brown, mechanical engineer, Aultman-Taylor Company, on "Materials of Boilers: Facts and Theories"; Mr. Oscar F. Rabbe, mechanical engineer, Heisler Pumping Engine Company on "Pumping Engines and Machinery"; Mr. Ezra Fawcett, consulting engineer, on "Notes on Settings of Horizontal Tubular Boilers."

The Meldrum destructor has been already described in PAGE'S WEEKLY, and its distinguishing features are familiar to engineers. It will be interesting however to refer to some of the tests

recently made, as the figures are instructive as to what is being achieved in destructor works of the latest type. A test made at Woolwich last year gave very satisfactory results, the guarantee being easily fulfilled, and the chief electrical engineer of the borough has recently stated that, providing that there were sufficient refuse to keep the destructor going continuously, the Woolwich plant could beat all records for the efficient production of steam from London refuse. Attention may also be directed to the test recently made with the plant at Stoke-on-Trent, where, with actual refuse, it is stated that the result was to show 108 units per ton of refuse destroyed; a figure which is claimed as a record. An important point in connection with destructors is that of upkeep and its relation to first cost. Coming down to practical results, as effecting the public, it is stated that the economy effected by the working of the Sheerness plant has resulted in a reduction of 2d. per £ in the rates.

The King of Belgium, on his recent visit to the Liège Exhibition, was very pleased to see that Great Britain was represented in the exhibition, and intimated to Mr. Imre Kiralfy, the Commissioner General, his intention of making a special visit to the British section at an early date.

THE TRADE OF JAPAN.

HER IMPORTS OF LOCOMOTIVES, MACHINERY, ETC.

AT the present juncture, when the momentous question of peace between Russia and Japan is taking practical shape, it is interesting to survey the position of the two countries from an industrial standpoint. That of Russia has been brought home to us for some months past by our morning papers, which have chronicled a series of industrial upheavals unparalleled in the Empire of the Slavs. The depression occasioned by these wholesale strikes can be little short of ruinous. Its effects have been concealed with great persistence, but it needs no official certificate to prove that the burden of the war will fall heavily upon the producers of the country.

In the case of Japan, we have a very different picture, the details of which are supplied by an admirably lucid report on the trade of the country by Mr. G. Barclay, secretary to His Majesty's legation at Tokio. With the help of this report, compiled with the assistance of the Yokohama Board of Trade, and collaborators in Yokohama and Tokio, we are able to obtain a very fair idea of Japanese industrial affairs to the end of 1904.

Thanks to the long period of cautious trading which followed the economic crisis of 1899-1900, Japan's trade was in a thoroughly healthy condition when war broke out. Since then she has been in almost uninterrupted possession of the command of the neighbouring seas, so that her foreign trade has not suffered serious inconvenience, and, in addition to this, Nature has come to her assistance with very abundant crops. Owing to these circumstances Japan has borne the strain of the first 12 months of war with remarkable ease. Indeed, so far the heavy drafts made on the country's capital by loans and increased taxation, the war's high

toll on the labour market, and the general dislocation of the native shipping occasioned by the army's transport requirements, do not seem, generally speaking, to have impaired her commercial and industrial activity. Her foreign trade has reached a level not only in imports but also in exports considerably higher than that of any previous year. It has been the policy of the Government to purchase as much as possible in Japan—it has been asserted that 70 per cent. of the war expenditure has been spent at home—and there are many examples of struggling industries which have been built up into successful concerns by the large demands on their capacity. Price has not been so much of a consideration as in ordinary times, and the manufacturers have thus been enabled to strengthen their position and to increase both their experience and production, so that we are likely to see Japan emerge from the war with her efficiency in certain branches of industry greatly improved.

IMPORTS AND EXPORTS.

As compared with 1903, the increase in the total volume of Japan's foreign trade as recorded in the Customs has amounted during the past year to £8,566,159, or nearly 14 per cent. Imports have increased in value by over £5,500,000, or 17 per cent., and exports by over £3,000,000, or 10 per cent. Among the items contributing to this expansion were, in imports, coal, steamships, petroleum, machinery, and tin plates. Broadly speaking, it may be said that the imports which show declines and the exports which show most progress were manufactured or partly wrought products—a most satisfactory indication of the development of the native industries.

LOCOMOTIVES.

Year.	Value.			
	United Kingdom.	United States.	Germany.	Total.
	£	£	£	£
1901	174,000	87,000	10,000	272,000
1902	174,000	73,000	11,000	259,000
1903	158,000	115,000	9,000	283,000
1904	249,000	44,000	32,000	327,000

MACHINERY and Engines.

Year.	Value.			
	United Kingdom.	United States.	Germany.	Total.
	£	£	£	£
1901	659,000	288,000	187,000	1,200,000
1902	335,000	285,000	112,000	822,000
1903	415,000	294,000	82,000	880,000
1904	492,000	371,000	115,000	1,008,000

IRON, Bar and Rod.

Year.	Value.				
	United Kingdom.	Belgium.	Germany.	United States.	Total.
	£	£	£	£	£
1901	68,000	142,000	132,000	..	359,000
1902	65,000	162,000	128,000	..	369,000
1903	56,000	178,000	126,000	..	368,000
1904	84,000	198,000	114,000	33,000	489,000

RAILS.

Year.	Value.				
	United Kingdom.	United States.	Belgium.	Germany.	Total.
	£	£	£	£	£
1901	38,000	102,000	6,000	21,000	164,000
1902	140,000	..	32,000	6,000	170,000
1903	115,000	..	30,000	135,000	281,000
1904	18,000	66,000	39,000	49,000	178,000

WIRE NAILS.

Year.	Value.		
	Germany.	United States.	Total.
	£	£	£
1901	68,000	63,000	139,000
1902	99,000	48,000	148,000
1903	70,000	79,000	154,000
1904	99,000	86,000	200,000

IRON and Steel other than above.

Year.	Value.				
	United Kingdom.	Belgium.	Germany.	United States.	Total.
	£	£	£	£	£
1901	448,000	65,000	35,000	59,000	712,000
1902	498,000	89,000	79,000	17,000	713,000
1903	623,000	91,000	74,000	4,000	813,000
1904	715,000	96,000	88,000	120,000	1,073,000

IMPORTS FROM GREAT BRITAIN.

The value of imports from the British Empire was 24 per cent. higher than in the previous year, its share in Japan's custom amounting to 41 per cent. of the whole as against 39 per cent. in 1903. The Empire still maintains the second place as a customer of Japan, though her share in the total exports has fallen from 23 to 21 per cent. Having regard to the United Kingdom's position as the principal source of supply for ships, for steam coal, and for certain classes of textiles needed for army purposes, it was only to be expected that in 1904 she should have had a much larger share in this country's custom than in ordinary years, and in effect Japan has taken from her 54 per cent. more than in 1903, the value of the increase being £2,681,000, or 48 per cent. of the total increase in this country's imports. With 20 per cent. of the total imports the United Kingdom has resumed her place at the head of the list which she had always held until India passed her in 1903.

TRADE WITH CHINA, COREA, ETC.

In spite of the situation in Manchuria, Japan's trade with China has made further substantial progress both in exports and imports. The chief items showing higher values from the United States last year were petroleum, leather machinery, and rails; but in addition to these staples there were smaller increases in other products, such as tin plates, iron bars and rods, etc., hitherto principally supplied from Europe. Exports to Corea show satisfactory development but imports are lower. The past year should mark the beginning of a new era in the trade between the two neighbouring Empires. With the opening up of the country under Japan's auspices, Japanese yarns and textiles should have a great future in Corea.

LOCOMOTIVES AND MACHINERY.

The annexed tables show how the trade in locomotives, machinery, and engines and iron

and steel manufactures has been shared by different countries during the last four years :—

The principal features noticeable in the trade in locomotives are a large increase in imports from the United Kingdom, a corresponding decrease from the United States, and a big jump in the imports from Germany.

Hitherto German locomotives have seldom been imported, but in 1903 and 1904 several good orders were taken by German builders, the first deliveries arriving about the end of the year. Quite a number remain to be delivered, and the figures for Germany may be expected to show a further increase during the current year. The decline in American locomotives is probably due to temporary causes ; in fact competition from this source for recent orders has latterly been very keen. Imports from the United Kingdom represent 75 per cent. of the total. It is interesting to note that during the past year the British type of locomotive obtained the preference, and that all the German locomotives and many of those from America recently imported or still on order are of British type and standards. So far as price goes, the three countries seem to compete on about equal terms. Germany now requires the longest time for manufacture, while there has been little to choose between the United Kingdom and the United States in this particular.

The figures for machinery and engines for 1904 are satisfactory, and there is no doubt this trade admits of considerable expansion. Japan still requires much machinery for the development of her resources and industries. Speaking generally, the American manufacturer is, as a rule, able to deliver quicker, partly because of larger capacity and partly because many standard machines are kept in stock, and they possess a great advantage by reason of their supremacy in electrical machinery. Allusion was made last year to the further advantage enjoyed by America from the fact that many of the Japanese engineers obtain

their education and gain their experience in the United States. In some branches, such as textile machinery and heavy machinery of every kind, the United Kingdom maintains its pre-eminence, but in the great variety of smaller machines both the United States and Germany are competing strongly.

NOTES ON ESTIMATING.

It may be stated here that not only in machinery but in many other articles the buyer of American goods is better able to estimate the ultimate cost than in the case of British manufacturers. The American maker generally issues priced catalogues, and will state discount in an accompanying letter ; his prices are usually for machines packed and delivered on the cars. The American Railway Company taking charge of the goods will quote a through rate of freight per 100 lb. from the factory to the port of destination. Given an American catalogue, with the discounts, the weights of the machine and the through rate of freight, it is an easy matter to estimate the laid-down cost. Many British manufacturers will not quote discounts except against specific inquiries. Packing is often an unknown extra. So are the rail and steamer charges. As a result, the resident merchant finds it difficult to quote prices without a reference home, and thus many an order finds its way to America because the total cost can easily be reckoned and a price quoted without delay.

THE AMERICAN STEEL TRUST.

In metals generally one important feature of last year's trade lies in the imports from the United States of merchant bars, plates, sheets and tin plates. Hitherto the supplies of these articles came from Europe, but the American Steel Trust has now begun to compete, and though the quantities so far are not large, the important fact remains that a commencement has been made. Years ago not a nail came from the United States ; now that country

divides the trade with Germany, and it may be that the same results will obtain from their invasion of other branches of the metal trade.

THE JAPANESE STEEL WORKS AT WAKAMATSU.

Another important feature of the year under review is the increasing production in Japan due to the Imperial Steel Works at Wakamatsu. Rails, bars, angles, and plates are now being turned out in quantities by these works, while machinery is being ordered for the production of telegraph wire, rivets, bolts, nuts, etc. At present the whole of the production goes to meet Government requirements, but in the near future the importers will find a serious competitor in this establishment.

It may safely be said that but for the war most of the rails imported during the past year would have been manufactured in Japan at the Imperial Steel Works. Figures are not available, but it is known for certain that about 18,000 tons of 60-lb. rails were manufactured there for use in building the military lines in Korea, besides many thousand tons of lighter rails. The United Kingdom's share of the rail import to Japan is reduced to 10 per cent., and as anticipated in the Legation's report for 1903, the largest share in the trade has fallen to America. British prices have been higher than those of other countries, and besides this, British steamers have on certain occasions refused to carry railway material. Belgium and Germany have supplied several lots of tramway rails, a speciality not obtained from the United Kingdom.

Imports of "iron bars and rods" from the United Kingdom now consist almost entirely of special qualities to be used in railway work, carriage building, etc. The ordinary merchant trade is entirely supplied from Belgium and Germany, and latterly the United States, the British makers being apparently unable to supply a satisfactory quality at a competing price.

Imports of wire nails have increased, probably

because a native factory has practically ceased working after running for several years. The bulk of the trade is about equally divided between Germany and the United States, probably by arrangement between the trusts which control the trade in those countries.

There has been an unusual demand for tinned plates and sheets on account of the war, imports being valued at £276,000, as compared with £99,000 in 1903. America had a large share in the trade, price being a secondary consideration and quick delivery important.

EXPORT OF COPPER AND COAL.

The decline in copper exports 20,775 tons, valued at £1,318,000, against 27,400 tons and £1,522,000 is attributable to increased demand in Japan owing to the war, and does not reflect any diminution in the output, which increases year by year. The exact figures are not yet available, but the output for 1904 may approximately be put at 35,000 tons. The bulk of the trade—£869,000, as against £384,000 in 1903—was with China. Prices in Japan have been higher than in Europe, and the shipments to that continent were much less than in 1903. Indeed, since April, 1904, they have ceased altogether. The decrease in the export of coal is also due not to diminished output, but to exceptional requirements at home. The figures for the year were 2,878,503 tons, valued at £1,515,000, as against 3,433,459 tons and £1,966,000 in 1903.

The following tables show how exports of coal and copper have been distributed:—

COAL.

Year.	Value.						
	India.	Straits Settlements.	Dutch Indies.	Hong-Kong.	Philippines.	United States.	Total.
1902 ...	£ 12,000	£ 277,000	£ 41,000	£ 535,000	£ 83,000	£ 19,000	£ 1,767,000
1903 ...	£ 32,000	£ 264,000	£ 56,000	£ 800,000	£ 60,000	£ 70,000	£ 1,966,000
1904 ...	£ 32,000	£ 260,000	£ 37,000	£ 500,000	£ 58,000	£ 24,000	£ 1,515,000

COPPER.

Year.	Value.						
	India.	China.	France.	United Kingdom.	Hong-Kong.	Straits Settlements.	Total.
1902 ...	£ 17,000	£ 186,000	£ 11,000	£ 136,000	£ 520,000	£ 266,000	£ 1,046,000
1903 ...	£ 46,000	£ 364,000	£ 25,000	£ 190,000	£ 674,000	£ 164,000	£ 1,822,000
1904 ...	£ 40,000	£ 889,000	£ 43,000	£ 22,000	£ 280,000	£ 2,000	£ 1,518,000

* This term includes mild steel bars and rods.

EXPORT OF CAMPHOR.

Camphor shows a decline in quantity of 21 per cent.—1,870 tons against 2,372 tons. The falling-off in value, £323,000 against £361,000, is not so heavy, prices having ruled high, owing to a shortage in the Formosa supply, due to merely temporary causes. At the time of writing a further advance in the price was expected, a condition which may stimulate further researches into artificial camphor. The natural product, however, is not seriously threatened by its artificial competitor in its present form.

JAPANESE SHIPPING.

Shipping conditions have of course been altogether abnormal during 1904. At one time the Nippon Yusen Kaisha alone had 71 vessels, representing 252,000 tons, chartered by Government for transport purposes, and though some of these ships have since been released, the native tonnage diverted during the greater part of the year from mercantile to military uses amounted to over 500,000 tons. Foreign vessels were chartered by the companies to fill the vacancy thus created. These were specially permitted to engage in the coasting trade to the unopened ports of Japan. Their number at the end of the year was 75 (of which 18 were British, 10 German, and 24 Norwegian), aggregating 150,000 tons. Earlier in the year this total was considerably exceeded, but it was never large enough, even with the help of the steamers transferred to the Japanese flag during the year, to make good the deficiency in the native shipping, and the big companies had

practically to abandon their oversea lines, though most of these lines had little to fear from Russian cruisers.

THE YEAR'S SHIP-BUILDING.

The annexed table gives the output of the native shipyards in 1904 as compared with 1903.

It will be seen that there has been a slight falling-off in the output of 1904 as against 1903. This is due partly to the fact that a large part of the 1903 tonnage was launched during the latter part of the year, and orders since placed have not yet been executed. The war has also interfered with the placing of new orders, owners not caring to risk building until they could see what was going to be its effect on shipping.

Among the private shipbuilding companies the output from the Mitsu Bishi Company comes easily first, though the table does not represent the total work of the firm, repair work having been unusually heavy. The company has been busily improving and enlarging its plant and shipbuilding slips, and has partly constructed a floating dock for new works about to be established at Kobe; it has also nearly completed a new graving dock capable of docking the largest ships afloat. The Kawasaki Company at Kobe has had a very busy year, and, as in the case of the Mitsu Bishi Company, the above table does not give an adequate idea of the amount of work done. Like the former company, it is enlarging and improving its works. The same may be said of the smaller yards, and though the total output of vessels for last year shows a decline, and the immediate outlook appears somewhat clouded by last year's extensive purchases of foreign ships, there is a general tendency towards a great development in building during the next few years, and preparations are being made to meet increased requirements.

The question of establishing a fleet of volunteer ships has been discussed in certain quarters in Tokio. 15,000,000 yen (£1,530,000), to be

	Number of Vessels.	Tonnage.	
		1904.	1903.
Imperial Dockyard, Kure	2	304	1,710
The Mitsu Bishi Works (steamships, "Dairei Maru," 1,199 tons; "Chohakusan Maru," 2,029 tons; "Tango Maru," 7,300 tons; all over 1,000 tons)	3	10,523	14,940
Kawasaki Dockyard (two steamships over 1,000 tons respectively; 1,100 and 2,200)	9	6,193	5,218
Osaka Ironworks	14	4,191	3,518
Others	43	12,795	10,025
Total	71	34,016	35,411

raised by public subscription, is the sum mentioned as required for the purpose. The general design of the vessels and the service on which they could best be employed in peace time are now being discussed by the promoters of the scheme. If the plan ever matures there is little doubt that the larger proportion of the vessels will be built in Japan.

TO ENCOURAGE FOREIGN CAPITAL.

Laws have just been passed by the Diet which show a real desire on the part of Japan to offer reasonable inducement to the foreign capitalist. Hitherto the holders of so-called debentures in this country have had no rights beyond those of any ordinary outside creditor of the company, and their security has therefore been no better than that of preference shareholders in other countries. Under the various

mortgage laws just passed holders of debentures issued in accordance with their provisions will have a prior lien on the property, land and plant against which the debentures are issued, and by another new measure, known as "the Law of Trust for secured debentures," they will be able, in the event of default either of interest or principal, to exercise their rights of foreclosure through a "trust" company corresponding in large measure to the trustees for the debenture holders in British practice. Any company, limiting its operations to banking and trust business may undertake this function provided it is domiciled in Japan with a capital of 1,000,000 yen (£102,000), of which half must be paid up. The total sums which may be borrowed under the proposed laws are fixed at the equivalent of the paid-up share capital less the amount of loans already obtained.

NEWS ITEMS.

North of England Mining and Mechanical Engineers.

A general meeting of the members of this Institute was held in Newcastle-on-Tyne on Saturday, June 10th, under the presidency of Mr. T. W. Benson. A paper was submitted by Mr. J. Cresswell-Roscamp on a method of spraying the roof and sides with water by means of pumps fitted into water tubs. They elicited the criticism that water only effectually damps the surface of the dust, and unless it was frequently used and in a strong ventilating current in hot and dry mines, the watering was very soon rendered ineffectual.

Another paper, by Mr. M. F. Holliday, dealt with the discovery of a fire caused through the ignition of a heap of fine coal dust owing to a labourer having carelessly left upon it a 16 c.p. electric light bulb.

A paper was also read by Mr. Donald M. D. Stuart on the development of explosives for coal mines. The conditions under which explosives are officially tested was criticised as being fundamentally different from those under which they are practically used, and the writer quoted figures to show that during the six years in which the Home Office orders dealing with this question have been in force the number of explosions has materially increased as compared with

the previous six years when colliery managers were unrestricted in their choice of explosives.

Electrical Association of New South Wales.

At the first general meeting of the present session of the Electrical Association of New South Wales, the president, Mr. T. Rooke, electrical engineer to the City of Sydney, delivered his annual address, which was listened to with much interest, and at the conclusion of the meeting a visit of inspection was paid to the Sydney City Council's electric light station. In commenting on his address, the Australian Mining Standard says that he touched the right chord when he urged that, while the technical training obtained in Australia was excellent, there was a lack of factories. There was, he said, a widespread belief amongst the younger members of the profession that a technical training was sufficient; but though the workshops of a university or technical college could teach a great deal, they could not instil those principles which governed factories. The university supplied the weapons and the factory taught their use. Mr. Rooke has placed at the disposal of the Council of the Association the sum of £100, the interest on which is to be devoted to the purchase of an annual prize for the best original paper presented to the Association.

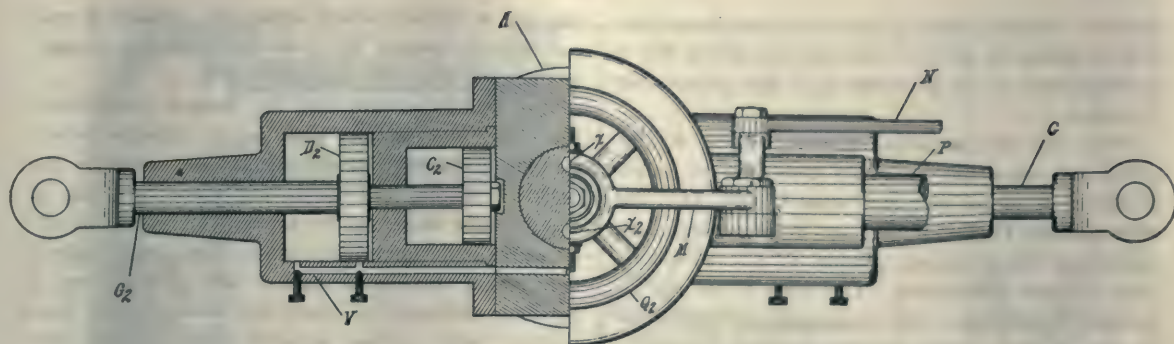


FIG. 1.

STEAM ACTUATED VALVE GEAR.

BY W. H. COLLIER.

NOTWITHSTANDING the high engineering talent engaged in engine design and the vast number of improvements made in recent years, it still appears to be possible to greatly improve the present types of reciprocating engines when efficiency and construction are considered. Attempts to secure a perfect distribution of steam by mechanically operated valve gears have necessarily resulted in complicated mechanism and excessive friction in these parts and usually limits the rotative speed of engine, while the point of cut-off in most cases is limited to one-half stroke with a constant point of compression.

These objectionable features, it is believed, have been overcome by the engine described in this paper, and, aside from simplicity of construction and increased economy due to high rotative speed and minimum clearance, the following advantages are claimed:—

Perfect distribution of steam, all movements of valves are full and instantaneous, cut-off varying under control of governor from no load to full stroke, and variable compression.

Closer regulation as governor has absolutely no work to perform, but merely indicates point of cut-off.

No safety device is necessary, as the speed limit is governed by velocity of steam through admission port of governing valve, which makes it impossible for speed of engine to increase 50 per cent. above that for which it is designed.

A higher rotative speed of engine, speed of engine being limited by piston speed only.

Engine is reversible, may be made to run in either direction, started or stopped by means of sliding key.

A valve gear in which it is impossible to get valves out of adjustment.

A more economical valve gear, doing away with friction and weight of releasing gear, dash pots, rocker arms, eccentrics, etc., steam on actuating pistons being used expansively.

The following is a description of a 14 by 30 engine running 100 revolutions per minute, developing from 80 to 120 h.p., and has been in operation ten hours per day for the past six months in the power plant of Southern Engine and Boiler Works, and has verified the above claims.

The body or frame A of this device is connected to side of cylinder as shown in figs. 1, 2 and 3.

The controlling valve B is connected to gears J and J2 by sliding key Q, and in such a way as to engage either of the gears J or J2, or may occupy a central position, in which position the gears are free to move on sleeve K. Shaft L, which is fixed to controlling valve B, is connected to sleeve K by sliding key, which causes controlling valve to revolve with sleeve K but allows a free lateral motion. Lateral motion being imparted to controlling valve B by a bell crank M, which is connected to governor by a reach rod N. The gears J and J2 are caused to revolve by gear O, which is connected to shaft of engine by shaft P and gears. The gears are so proportioned as to cause main shaft of engine and controlling valve to make the same number of revolutions. The two gears J and J2 are for the purpose of reversing engine. The valve revolves in the direction indicated by arrow and if it is desired to run engine over, controlling valve is connected to gear J, which causes the controlling valve to revolve in the direction indicated by arrow; if engine is to run under, controlling valve is connected to gear J2, which causes engine to run in

opposite direction while it revolves controlling valve B as indicated by arrow. The slots for sliding key Q in gears J and J₂ are so located as to give proper lead to engine.

There are four actuating pistons, C, C₂, E, E₂, which are connected to steam and exhaust valves of engine by means of rocker arms U (fig. 3). The large pistons, D, D₂, F, F₂, are for the purpose of cushioning the actuating pistons, C, C₂, E, E₂, in their extreme movements. The ports V are for the purpose of allowing a free movement of the pistons D, D₂, F, F₂, except at their extreme points of movement.

The controlling valve B has a series of oblong and helical grooves which are connected either to the exhaust passage X₂ or to the steam passage X by means of ports not shown.

The steam passage X is connected to steam pipe I by means of the annular groove X₃. Actuating pistons C, C₂, E, E₂, have ports Y, Z, at end of their cylinders.

The exhaust passage X₂ extends into opening in

the side of cylinder which allows the exhaust to pass out through opening X₅ to the main exhaust passage of cylinder or to the atmosphere (fig. 2).

The helical grooves S₃, E₃ control respectively the steam and exhaust passages of cylinders, which contain actuating pistons C, C₂, and regulate the point of cut-off, the controlling valve revolving in the direction indicated by arrow. The point of cut-off varies as the lateral movement of controlling valve; this lateral motion is caused and governed by a governor connected to reach rod N, and as the controlling valve moves outward from cylinder the helical groove S₃ comes more quickly in contact with ports Z, moving actuating piston inward, closing the admission valve of engine, while at the same time the helical groove E₃ which is connected to the exhaust passage X₂ uncovers the port Y of piston C allowing steam in that end to exhaust out through passage X₂.

The oblong grooves S₄, E₄ control the actuating pistons C₂, opening admission valves of engine. They being parallel with the movement of controlling

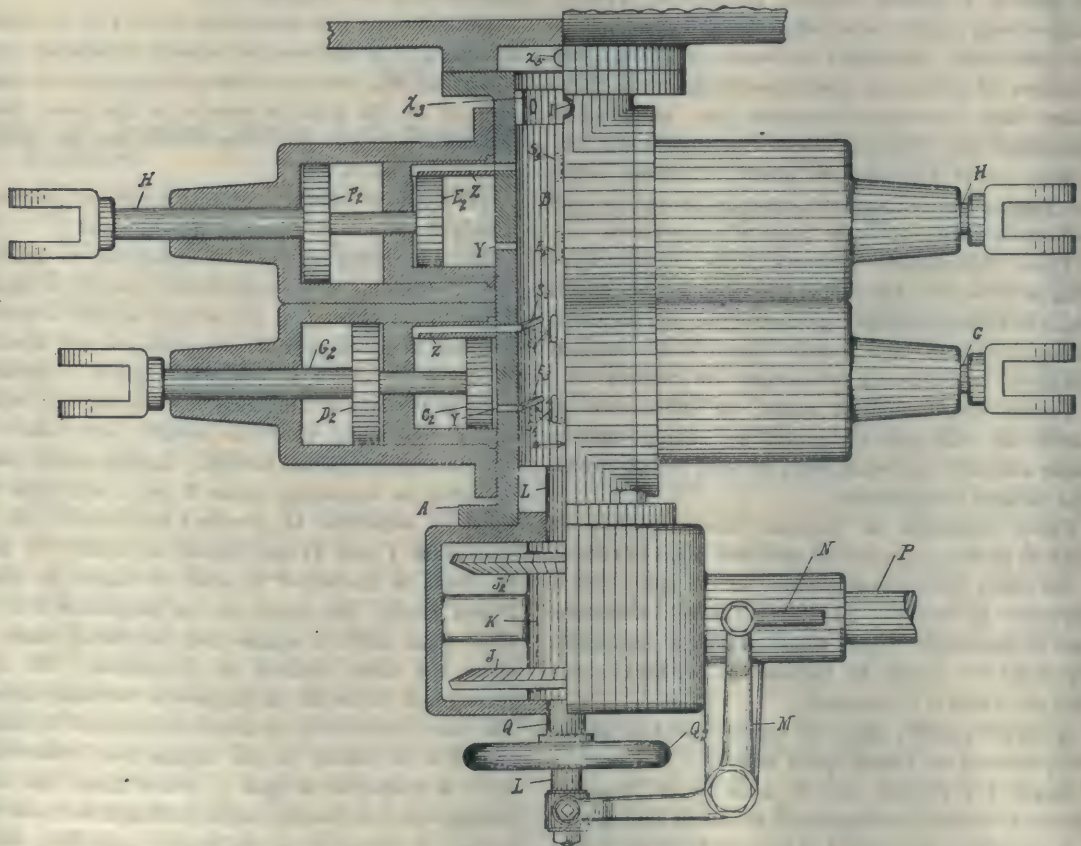


FIG. 2.

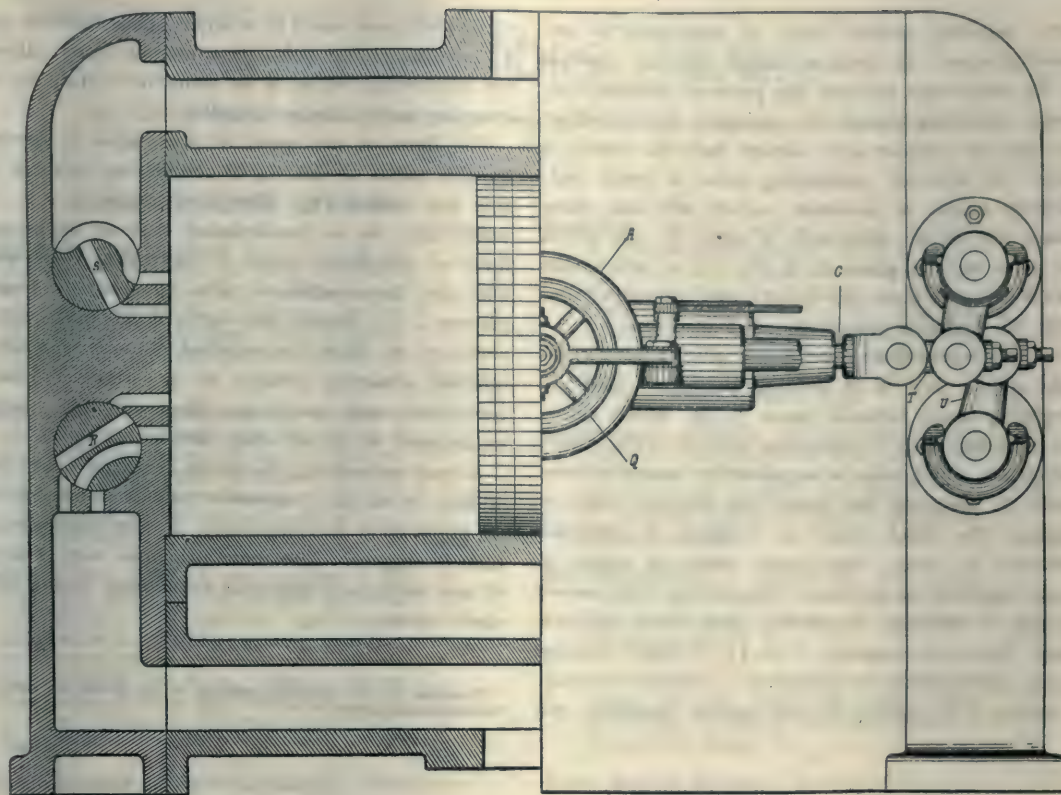


FIG. 3.

valve are not affected by the lateral movement of same; that is, the point of admission remains constant. The same is true of the oblong grooves E_5 , S_5 , which are on the opposite side of controlling valve, and which control the actuating pistons E , E_2 , which operate exhaust valves of engine during release. Actuating pistons E , E_2 , operate the exhaust valves of engine during compression and are controlled in this movement by helical grooves S_6 , E_6 not shown.

The grooves S_3 , S_4 , S_5 , and S_6 , are connected to steam passage X and the grooves E_3 , E_4 , E_5 , and E_6 , are connected to the exhaust passage X_2 .

The outlets of ports Y , Z , of cylinder which contain piston C , are diametrically opposite those of cylinder containing piston C_2 and in the same vertical plane. The same is true of the outlets of cylinders containing pistons E and E_2 .

Assume engine to be rotating in direction indicated by arrow head and to be on dead centre. At this instant the oblong passage S_4 is admitting steam on inner face of actuating piston C_2 through port Y , opening the admission valve at this end of cylinder while oblong passage E_4 has opened the exhaust passage Z at opposite end of C_2 . At the same instant

the oblong groove S_5 has uncovered port Y , forcing actuating piston E outward, opening exhaust valve at that end of cylinder. Oblong passage E_5 uncovering exhaust port Z at this instant. The engine and controlling valve B will continue to revolve until helical grooves S_3 , E_3 , uncover respectively the steam and exhaust ports of cylinder containing actuating piston C_2 , causing piston to move inward, cutting off steam at this end of cylinder. The engine and controlling valve continue to revolve until the helical grooves S_6 , E_6 uncover the openings Z , Y , respectively forcing actuating piston E inward, closing exhaust valve at that end of cylinder, causing steam to be compressed until end of stroke is reached, when engine starts on return stroke the movements of the valves are reversed until the engine completes its cycle.

It will be observed that as the speed of the engine increases controlling valve B (fig. 2) is forced outward, that is, away from cylinder by means of governor connected to reach rod N , bringing the helical grooves S_3 , E_3 , S_6 , E_6 nearer their respective ports, which causes an earlier movement of their respective actuating pistons. That is, as these helical grooves are forced outward they approach more closely their respective

ports, requiring smaller angle of movement in uncovering same. In position shown (fig. 2), grooves S₃, E₃, would not uncover the ports of cylinder containing actuating piston C₂, operating the cut-off at that end of cylinder until almost half the stroke is made; if, however, controlling valve is forced outward by means of governor, cut-off will take place earlier and earlier until ends of ports S₃, E₃, are in the same vertical plane Z, Y (fig. 2), in which case cut-off will take place the instant after admission, and while the engine is practically on dead centre.

To start engine from state of rest, pin Q is withdrawn until sliding key is in central position; that is, occupying space between gears J, J₂, which allows sleeve K, and with it controlling valve V, a free rotary movement, which may be imparted by means of hand wheel Q₂ operating the steam and exhaust valves of engine. The hand wheel is revolved in direction indicated by arrow, this leaves valves of engine in proper position in starting. The key is then pushed inward or outward, depending upon which direction engine is to run, engaging J or J₂, in which position engine will continue in motion.

Should it be desired to stop engine instantly, pin

Q is withdrawn until it occupies space between gears J, J₂, disengaging sleeve K from said gears, allowing the controlling valve B to come to a state of rest, stopping engine almost instantly.

The limit of the speed of the engine is governed by the width of slot S₄ of controlling valve B, and this slot controls the admission pistons C, C₂. The width may be so proportioned that at the required limit of peripheral speed of controlling valve steam will not have sufficient time to operate admission pistons C, C₂, that is, the width of this port might be sufficient to allow the required amount of steam to operate actuating pistons at a certain number of revolutions and would not allow sufficient steam at an increase of 50 per cent. above this speed.

A gear embodying the above features is now being applied to an air compressor, and it is believed that its application to compressors is even more desirable than to engines. The above principles may be applied to any stationary engine or locomotive having two or more valves.

Presented at the Scranton meeting of the American Society of Mechanical Engineers.

NEWS ITEMS.

The Elliott-Fisher Company, whose billing machines and book typewriters are filling a special position in modern business organisation, are moving from 87, Gracechurch Street, to new and extensive premises at 75, Cannon-street, E.C.

The cable steamer *Cambria* has started from Queens-town, en route for Cape Canso, Nova Scotia, to take soundings from 190 miles west of Waterville, Kerry, across the Atlantic, for the purpose of selecting the route for the new cable of the Commercial Cable Company.

We understand that in a few weeks the stretch of line between Leek and Waterhouses will be opened connecting up the former place with the Manifold Valley. The Leek and Manifold Light Railway was described in these columns last August.

The German pig-iron production of 1904 was very little higher than in 1903, but in that year the production was an unusually large one. For the last

five years the output compares as follows, taking the 1900 production as 100: 1904, 119.96 per cent.; 1903, 119.74 per cent.; 1902, 99.76 per cent.; 1901, 92.44 per cent.; 1900, 100 per cent. The total production of pig-iron in Germany, including Luxembourg, was 10,104,000 tons, as compared with 10,086,000 tons in 1903.

The German Navy.

The Berliner Tageblatt learns that in the new German Navy Bill, which will be laid before the Reichstag in the autumn, an increase in the size of battleships will be demanded. A year ago, in spite of the fact that England and America were constantly increasing the displacement of their battleships, the German Navy department was of opinion that a displacement of 13,200 tons was sufficient. Now, however, German naval experts have come to the conclusion that it will be necessary considerably to increase the displacement, probably to 16,000 tons.

CONTRACTORS' NEWS.

We shall be pleased to insert under this column, free of charge, particulars of open contracts

CONTRACTS OPEN.

Brigg.—For laying about 15,000 yards of cast-iron water-pipes, ranging from 3 in. to 7 in. in diameter, and for the supply and fixing of valves and fittings, for the Brumby and Frodingham Urban District Council. Mr. Alfred Atkinson, C.E., of Brigg ... Last Day, June 19

Cricklewood (Middlesex).—Construction of covered reservoirs, the laying of pipes, the formation of roads, culverts, etc., at Cricklewood, Middlesex, for the Metropolitan Water Board. District secretary, at the New River District Office, 173, Rosebery-avenue, E.C. ... June 22

Hull.—Supply, delivery, and erection of the following plant, for the Electric Lighting Committee: one 500-k.w. high-tension continuous-current high-speed generating set; one 500-k.w. low-tension ditto; six 30 ft. by 8 ft. 6 in. high-pressure Lancashire boilers with downtake superheaters. Copies of City Treasurer, Town Hall, Hull ... June 22

Aston Manor (Birmingham).—For the electrical equipment on the overhead trolley system of tramways in their district, for the Corporation. Contractors desiring to submit tenders for the work are requested to send applications to the consulting engineer of the Corporation, Mr. Robert Green, A.M.I.C.E., 37, Waterloo Street, Birmingham ... June 23

Shenfield (near Brentwood).—Construction of pumping stations, sewers, and filtration beds in the district of Shenfield, near Brentwood, for the Billericay Rural District Council. Council's engineers, Messrs. Jones, Parliament Mansions, Victoria Street, Westminster ... June 24

Manchester.—Supply of the iron and steel work required for supporting an existing retort-house floor at their Rochdale Road gas station, for the Gas Committee. Mr. C. Nickson, superintendent, Gas Department, Town Hall ... June 24

Edinburgh.—Construction of an inclined retort carbonising plant to design, specification, and schedule of quantities prepared by their engineer, for the Edinburgh and Leith Corporations Gas Commissioners. Mr. W. R. Herring, M.Inst.C.E., chief engineer and manager, New Street Works, Edinburgh ... June 26

Ilford.—Erection of a dust destructor of six cells, viz., cells, flues, dustchamber, and boilers, for the Ilford Urban District Council. Mr. Herbert Shaw, A.M.I.C.E., engineer and surveyor, Town Hall, Ilford, Essex ... June 26

London.—Supply, delivery, and erection of the following plant in connection with their electricity generating station at Park Royal, for the Great Western Railway Company: (Specification 18) pipework, feed and other pumps, tanks, feed heaters, water-softening and oil-separating plant, etc. Messrs. Kennedy and Jenkin, 17, Victoria Street, London, S.W. ... June 26

Aberdeen.—Supply of permanent way materials, including steel rails and guard rails, steel fishplates and steel fishbolts, and rail clips for the dock railway. Mr. R. Gordon Nicol, harbour engineer's office, Aberdeen ... June 26

Southampton.—Supplying and fixing three weighbridges at their depots, for the Corporation. Mr. J. A. Crowther, borough engineer ... June 27

Leigh (Lancs.).—Supply of one water-tube boiler for the Electricity Department. Mr. Arthur T. Smith, electrical engineer, Town Hall, Leigh ... July 1

New South Wales.—Tenders will be received at the office of the Secretary for Public Works, Sydney, Australia, up to 2 o'clock p.m. on Friday, September 1st, 1905, for the manufacture, supply and delivery in the State of New South Wales of all iron and steel required by the Government. Full particulars may be obtained from the Agent-General's office, 9, Victoria Street, London, S.W. ... Sep. 1

COMING CONTRACTS.

Bradford.—The Town Council have decided to apply for sanction to borrow £60,000 for electricity works extensions.

Ilfracombe.—An inquiry has been held into the application for sanction to borrow £12,600 for purposes of water supply.

Epsom.—The Council have decided to instal a pumping plant of not less capacity than 50,000 gallons per hour.

Bath.—An inquiry has been held into the application of the Council for power to borrow £19,000 for electric light purposes.

Battersea.—Application has been made for sanction to the advance of a loan of £8,830 for extensions of the electrical generating plant and mains.

Gloucester.—An inquiry has been held into the Council's application for sanction to borrow £12,100 for electric supply extensions.

Grimsby.—Extensions of electric plant estimated to cost £9,000 are to be put in hand in the near future.

CONTRACTS CLOSED.

Motherwell.—The Stirling Boiler Company have secured the following orders: Edinburgh Corporation, M'Donald Road electric light and power station—Two Stirling boilers with superheaters and chain grate stokers, each boiler to evaporate 18,900 lb. of water per hour. Bournemouth Gas and Water Company—Two Stirling boilers, each to evaporate 7,000 lb. of water per hour, complete with piping, chimney and feed pumps.

Ledbury.—Mr. Percy Pitman, Bosbury, Ledbury, has recently received orders for Pelton water wheels as follows: For the Derbyshire mines of the British Mining and Metal Company, 150 b.h.p.; for North Wales, large wheel for the Glyn Slate Company; for South Africa, high-pressure wheel for the Cyanide Plant Supply Company; for Rio, Mexico, multiple nozzle wheel for A. and Z. Daw, of London; for Wanganui, New Zealand, multiple nozzle wheel for Mr. N. Andrew.

London.—The Holwell Iron Company, Ltd., of Ashfordby, near Melton Mowbray, have secured the order for supplying pipes and castings to the Metropolitan Water Board during the current financial year.

Stoke Newington.—Ferranti, Ltd., have received through Bruce Peebles and Co., Ltd., the order for the transformers required for stepping down the 10,000 volt three-phase current to supply the motor-generators for the electricity supply scheme. The ratio of transformation is 10,000:500; the transformers are oil cooled, and the total capacity is about 350 kw.

Halifax.—The tender of the British Insulated and Helsby Cables, Ltd., for the supply of 2,901 yards of tramway feeder to be laid from the electricity works to King's Cross, Halifax, has been accepted by the Electricity Committee.

New South Wales.—The New South Wales Government has placed an order with Clarkson, Ltd., for four "Chelmsford" steam omnibus chassis. A repeat order has also been received by the same firm from the Victorian Railways for two further chassis for omnibuses.

Tipton.—Joseph Wright and Co., of the Neptune Engineering Works, Tipton, inform us that they have recently booked a number of large orders for their multiplex heater detartarisers and Berriman feed-water heaters. Amongst these is a detartariser for Messrs. Steel, Peach and Tozer, designed to heat and soften 10,000 gallons of water per hour, whilst the East Rand Mines have ordered two more feed heaters. The firm have also recently supplied their improved King's safety hooks to a number of collieries, amongst the orders being one for eight of one size, required by the Tredegar Coal and Iron Company, Ltd.

Southampton.—John I. Thornycroft and Company Ltd., Woolston Works, Southampton, have contracted with Lord Howard de Walden to construct a single-screw steel yacht of about 200 tons Y.M. Length overall, 135 ft.; beam, 16 ft. 7 in.; depth moulded, 11 ft. 3 in.; speed 11½ knots. She will be rigged as a fore-and-aft schooner with two pole masts, and she will have a steam steering gear, steam capstan, electric light, and teak decks.

APPOINTMENTS VACANT.

London County Council.—The London County Council invites applications from fully competent engineers with good experience in the design and construction of the permanent way and general arrangement of electric tramways on the conduit system (if possible) and on the overhead system. Salary £7 per week. Clerk of the Council, County Hall, Spring Gardens ... June 27

London.—The governing body of the Northampton Institute, St. John Street Road, London, E.C., invite applications for the following appointments: Drawing office and lecture assistant, pattern maker and instructor in pattern making, junior drawing office instructor, laboratory demonstrator for engineering laboratories, junior technical assistant and evening instructor in automobile work, also junior technical assistant and junior lecture assistant in the electrical engineering department. Particulars and forms of application from the principal, Dr. R. Mullineux Walmsley ... June 26

Liverpool.—The Council of the University of Liverpool invite applications for the vacant chair of engineering. The income consists of a fixed stipend and share of fees, and is guaranteed at not less than £900 per annum for five years. Further particulars on application to the registrar ... June 21st

London.—A chief assistant is required in the mechanical engineering department of the Northern Polytechnic Institute, London, N. Salary £150 ... June 19th.

Leicester.—The Corporation require an assistant instructor in engineering at the municipal technical school ... June 19th

Lancaster.—A teacher of electrotechnics and electricity is required at Lancaster municipal technical school. £160 to £200 June 19th

APPOINTMENTS FILLED.

Midland Railway.—Mr. Wm. Guy Granet has resigned the secretaryship of the Railway Companies' Association to take up the position of Assistant General Manager of the Midland Railway.

Smyrna.—Mr. G. Willans, who was formerly locomotive engineer of the Wrexham, Mold, and Connah's Quay Railway, has been selected for the position of assistant locomotive superintendent of the Smyrna Railway.

India.—Mr. J. Willoughby Meares, has been appointed electrical adviser to the Government of India, a post only now established, and which he will be the first to fill.

Bournemouth.—The Corporation have appointed Mr. Bulfin resident engineer in connection with the construction of the Christchurch tramways. On the completion of this line he will act as electrical engineer for the whole of the system, at a salary of £400 per annum.

Share List of Engineering, Electrical, Iron and Steel, and other Companies.

The following is a comprehensive list of Companies in the industries covered by "Page's Weekly," in which shares business is being currently transacted. Additions will be made from time to time as occasion requires. We desire it to be understood that while our Share List will generally be found correct, we do not hold ourselves responsible for any loss or inconvenience that may arise from possible inaccuracies.

STOCK EXCHANGE SETTLING DAYS.—Settling days on the Stock Exchange are as follows:—

Consols: July 5th, Aug. 8th General Settlements June 29th, July 13th and 28th. Bank Rate, March 9th, 1905, 2½ per cent.

I.—ENGINEERING, IRON, AND STEEL COMPANIES.

ENGINEERING, IRON, AND STEEL COMPANIES.—Cont d.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.	Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
11,370	5	5%	Alldays & Onions Pneumatic Engineering, Ltd.	3	28-29	750,000	1	6d.	Howard & Bullough, Ltd., Ord.	1	18-19
10,000	5	3/-	Do. Cum. Pref. 6 per cent.	5	42-43	25,000	10	6/-	Do. 6% Pref. (Non-Cum.)	10	18-18½
8,210,000	1	1/-	Armstrong (Sir W. G.), Whitworth and Co., Ltd.	1	38-39	250,000	Stk	4%	Do. 4% Deb. Stk., Red. after 1905	100	97-100
76,970	5	2/-	Do. 4% Cum. Pref.	5	58-59	37,500	10	20	Kynoch, Ltd.	10	18-19
1,500,000	100	4%	Do. 4% 1st Mort. Dbs. Rd.	100	103-105	49,587	10	5%	Do. Cum. Pref. 5%	10	102-118
1,100,000	100	4½%	Aveling and Porter, Ltd., 4½% Reg Mt. Debs. Red.	100	96-99	300,000	1	4½d.	Lambert Bros., Ltd., Ord.	1	2-3
530,000	1	2½d.	Babcock and Wilcox, Ltd., Ord.	1	52-54	50,000	5	2/9	Do. 5½% Cum. Pref.	5	4-4½
100,000	1	7½d.	Do. 6% Cum. Pref.	1	17-18	40,000	2	2/1½	Leeds Forge Co., 7% Cum. Pref.	3	83-84
20,000	5	3/-	Baker (Joseph) and Sons, Ltd., 6% Cum. Pref.	5	42-43	200,000	1	7½d.	Lysaght (John), Ltd., 6% Cum. Pf.	1	109-111
250,000	1	6½d.	Baldwins, Ltd., 5½% Cum. Pref.	1	1-1½	£800,000	Stk	4½%	Do. 4½% 1st Mt. Deb. Stk., Red.	100	107-111
£250,000	Stk	4½%	Do. 1st Mt. 4½% Deb. Stk. Red.	100	103-105	40,000	10	5/-	Mather & Platt, Ltd., 5% Cum. Pref	10	112-113
150,000	4½	2½d.	Barrow Hematite Steel Co., Ltd., O.	4½	12-14	210,000	1	5½d.	Measures Bros., Ltd., Ord.	1	8-9
50,000	4½	3/-	Do. do. Cum. 2nd. Pref.	4½	48-49	75,000	1	6½d.	Do. 5½% Cum. Pref.	1	18-19
83,334	5	2/-	Bayliss, Jones and Bayliss, Ltd., 5% Cum. Pref. Shares	5	42-52	14,248	5	2/6	Do. 4½% 1st Mt. Db. Stk., Red.	100	92-95
£500,000	100	100	Beardmore (Wm.) & Co., Ltd., 4½% 1st Mt. Debs., Red., Scrip 50% pd	—	104-106	73,000	10	5/-	Muntz Metal, Ltd.	5	47-58
50,000	10	6/-	Bell Brothers, Ltd., 6% Cum. Pref.	10	12-13½	80,000	5	—	Do. Pref. 5%	5	46-56
£366,600	Stk	4%	Do. 4% Deb. Stock, Red.	100	100-102	£250,000	Stk	4½%	Nantyglo and Blaiza Iron Works, Ltd., 8% Cum. Pref.	62½	78-81
200,000	1	1/-	Beyer, Peacock and Co., Ltd., Ord.	1	15-17	122,000	5	1/6	N. Brit. Loco. Co., Ltd., 5% Cm. Pf.	10	128-129
300,000	1	6½d.	Do. 5½% Cum. Pref.	1	38-39	£250,000	Stk	4½%	North-Eastern Steel Co., Ltd., 4½% 1st Mt. Db. Stk., Red.	100	90-98
£300,000	Stk	4½%	Do. 4½% Red. Deb. Stock	100	96-99	50,000	5	—	Pearson & Knowles Coal and Iron Co., Ltd., Ord. "B"	5	34-46
1,629,760	1	6d.	Bolckow, Vaughan and Co., Ltd., O.	1	15-16	12,000	1	—	Do. 8% Cum. Pref. "A"	5	64-65
1,860,900	1	8½d.	Do. Nos. 1,629,760-2,500,000	12/-	4-10	50,000	5	3/-	Pease & Partners, Ltd., Ord.	10	94-10
1,160,000	1	4½d.	Brown (John) and Co., Lim., Ord.	15/-	14-15	70,000	10	6/-	Do. 4% Perp. Deb. Stock	100	97-100
590,000	1	6d.	Do. Ord., Nos. 1,160,001-1,750,000	10	11-12	£400,000	Stk	4%	Peebles (Bruce) & Co., Ltd., 6% Cm. P.	5	5-5½
74,000	10	5/-	Do. 5% Cum. Pref.	10	11-11½	20,000	5	3/-	Pooley (Henry) & Son, Ltd., Ord.	1	6/-6/6
154,500	5	5/-	Cammell, Laird & Co., Ltd., Ord.	5	88-89	65,000	1	—	Do. 5½% Cum. Pref.	5	4-4½
292,500	5	2/6	Do. 5% Cum. Pref.	5	58-59	19,000	1	—	Projectile Co. (1902), Ltd., Ord.	1	1-2
450,000	1	1/2d.	Clayton & Shuttleworth, Ltd., Ord.	1	18-19	126,988	5	2/-	Rhymney Iron Co., Ltd.	5	18-19
70,000	5	2/6	Do. 5% Cum. Pref.	5	58-59	73,062	5	2/-	Do. New	5	14-15
£250,000	Stk	4%	Do. 4% 1st Mort. Db. Stk. Red	100	101-103	£390,000	—	5%	Do. 5% Mort. Deb., Red.	100	102-104
100,000	10	7/6	Consett Iron Co., Ltd., Ord.	7½	81-82	850,000	1	7½d.	Richardsons, Westgarth & Co., Ltd., Ord. 80,001-700,000	1	32-37
57,031	10	10/-	Crossley, Bros., Ltd. Ord. 40340/97870	10	152-16	£350,000	Stk	4½%	Do. 4½% Perp. Deb. Stock	100	95-97
40,839	10	5%	Do. 6% Cum. Pref.	10	113-114	35,000	10	12/-	Ruston, Proctor & Co., Ltd.	10	94-100
75,000	1	2/6	Delta Metal, Ltd. Shares	1	24-26	275,000	1	6d.	Scott (Walter) Ltd., Ord.	1	12-13
1,259,594	1	8½d.	Dorman, Long & Co., Ltd.	1	15-16	800,000	1	7½d.	Do. 8% Cum. Pref.	1	1-1
£400,000	Stk	4%	Do. 4% 1st Mort. Perp. Deb. Stk.	100	89-93	£800,000	Stk	4½%	Do. 4% Perp. Deb. Stock	100	94-96
200,000	5	3/-	Dunderland Iron Ore Co., Ltd., 6% Cum. Pref. and Participating.	5	3-8½	£97,900	100	6%	Do. 6% 2nd Mort. Debs., Red.	100	98-96
250,000	1	9½d.	Dunlop (James) & Co., Ltd., Ord.	1	15-16	250,000	1	1/-	South Durham Steel & Iron, Ltd. Or.	1	34-38
300,000	1	7½d.	Do. 6% Cum. Pref.	1	15-16	300,000	1	1/2d.	Do. 6% Cum. Pref.	1	1-1
4,721	13	12/-	Ebbw Vale Steel, Iron & Coal Co., Ltd.	13	94-103	£800,000	Stk	4½%	Do. 4½% Per. Deb. Stock	100	90-92
69,754	13	12/-	Do. do. do.	10	74-75	49,560	10	2½d.	Steel Co. of Scotland Ord. 1/49560	9	58-62
20,250	10	8/-	Elliott's Metal, Ltd.	8	43-52	£125,240	Stk	5%	Do. 5% Trust Mort. Deb.	100	106-107½
5,000	10	5%	Do. Cum. Pref. 5%	10	92-93	25,000	10	—	Stephenson (Robert) & Co., Ltd. Or.	10	2-2½
186,748	Stk	4%	Do. Deb. 4%	100	92-94	25,000	10	5/6	Do. 5½% Cum. Pref.	10	4-4½
25,000	10	6/-	Fairfield Shipbuilding & Engng. Co., Ltd., 6% Cum. Pref.	10	11-12	£250,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	77-80
£250,000	Stk	4½%	Do. 4½% Mort. Deb. Stk. Red.	100	100-103	85,000	10	9/-	Stewarts & Lloyds, Ltd., Ord.	10	17-18½
9,000	10	10%	Fleming & Ferguson, Ltd. Ord. Nos. 1/9000	10	122-124	55,000	10	6/-	Do. 6% Cum. Pref.	10	14-15
6,000	10	5%	Do. 5% Cum. Pref. Nos. 9001/15000	10	94-10	684,732	1	6d.	Swan, Hunter & Wigham.	1	3-4
126,000	3	3/-	Fraser & Chalmers, Ltd., Ord.	3	44-45	538,845	1	6d.	Do. 5% Cum. Pref.	1	3-4
21,000	1	1/6	Do. 7½% Cum. Pref.	3	52-62	£240,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red	100	98-101
10,000	10	5%	Galloways, Ltd., 5% Cum. Pref.	10	6-7	300,000	1	6d.	Thames Iron Works, Shipbuilding & Engineering Co., Ltd., 5% Cm. Pf.	1	3-4
£150,000	Stk	4%	Do. 4% 1st Mort. Deb. Red.	100	904-913	£200,000	100	4%	Do. 4% Irredeem. 1st Mort. Deb.	100	76-80
16,800	10	—	Greenwood & Batley, Ltd., Ord.	10	44-48	£138,500	1	3%	Thornycroft (John I.) & Co., Ltd. Or.	1	15/-16/-
9,600	10	7%	Do. 7% Cum. Pref.	10	104-105	£160,000	1	7½d.	Do. do. 6% Cum. Pref.	1	1-1
965,000	1	1/-	Guest, Keen & Nettlefolds, Ltd. Ord.	1	23-28	10,000	10	5/-	Taylor (J.) & Sons, Ltd. 5% Cum. Pf.	10	94-10
344,000	5	2/6	Do. 5% Cum. Pref.	5	6-6½	£508,495,200	£100	8½	United States Steel Corp. Com. Stk.	£100	282-283
£1,850,500	Stk	4%	Do. 1% Irred. Mort. Deb. Stk.	100	105-107	£360,814,100	£100	8½	Do. 7% Cum. Pref. Stock	£100	972-973
13,000	5	2/6	Gwynnes, Ltd., 5% Cum. Pref.	5	9-9	1,322,800	£1000	1/6	Do. 10-10½% 6% Skg. Fd. G. Bds.	£1000	86-88
250,000	1	3/6	Hadfield's Steel & Iron Co., Ltd., Ord.	1	93-94	£360,814,100	1	5/6	Vickers, Sons & Maxim, Ltd. Ord.	1	27-28
20,000	10	4/6	Do. 4½% Cum. Pref.	10	102-111	750,000	1	6d.	Do. 6% Non-Cum. Pref.	1	1-1½
300,000	5	3/-	Hall (J. & E.), Ltd. 6% Cum. Pref.	5	5-5½	£750,000	Stk	5%	Do. 6% Non-Cum. Pref. Stock	100	112-121
408,505	1	1/6	Harvey Universal Steel Co., Ltd.	1	1-1½	£1,250,000	Stk	4%	Do. 4½% 1st Mort. Deb. Stk. Red.	100	105-107
47,500	10	7½d.	Hawthorn, Leslie & Co., Ltd. Ord.	10	99-101	£1,000,000	4½%	1/2d.	Do. 4½% 2nd Mort. Debs., Red.	100	105-107
28,001	5	7/-	Head, Wrightson & Co., Ltd.	5	5-5½	225,000	1	1/2d.	Weardale Steel, Coal & Coke, Ltd., Def. Ord.	1	13-14
85,000	1	7½d.	Hill (Richard) & Co. (1899) Ltd., Ord.	1	13-14	500,000	1	7½d.	Do. 6% Cum. Pref. Ord.	1	1-1
18,000	5	3/-	Do. 6% Cum. Pref.	5	43-53	£300,000	Stk	4%	Do. 4% Perpetual Deb. Stock	100	88-87
30,000	10	6/-	Hornsby (Richard) & Sons Ltd., Ord.	8	52-53	7,687	5	2/9	Weldless Steel Tube, Ltd., Cum. Pref. 5½	5	44-43

Stocks and Shares marked * are quoted ex-dividend.

II.—ELECTRICAL MANUFACTURING COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
70,000	1	6d.	Alliance Elec. Co., Ltd. 5% Cum. Pf.	1	5-8
125,000	1	7½d.	Aron Elec. Meter Ltd., 6% Cum. Pf.	1	18-18
120,000	1	1½d.	Bell's Asbestos Co., Ltd.	1	8-1
100,000	5	4/-	British Insulated & Helsby Cables Ltd., Ord.	5	5½-6
100,000	5	3/-	Do. 6% Cum. Pref.	5	5½-6
£500,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Rd.	100	102-105
£200,000	Stk	4½%	British Thomson-Houston Co., Ltd., 4½% 1st Mort. Deb. Stk. Rd.	100	100-102
400,000	5	8/-	British Westinghouse Electric and Manufac. Co., Ltd., 7% Pref.	5	2½-2½
£616,358	Stk	4%	Do. 4% Mort. Deb. Stk. Rd.	100	89-91
105,731	2	2/-	Brush Elec. Enging. Co., Ltd., Ord.	2	3-3
150,000	2	2½d.	Do. 6% Pref.	2	11-12
£125,000	Stk	4½%	Do. 4½% Perp. 1st Deb. Stk.	100	92-95
£125,000	Stk	4½%	Do. 4½% Perp. 2nd Deb. Stk.	100	79-82
35,000	5	7/6	Callender's Cable & Constn. Ltd. Ord.	5	10-11*
40,000	5	2/6	Do. 5% Cum. Pref.	5	5½-5½
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Rd.	100	107½-109½
85,000	3	1/6	Crompton & Co., Ltd.	3	12-2½
£100,000	—	5%	Do. 5% 1st Mort. Reg. Debs.	100	95-100*
52,000	5	10/-	Dick, Kerr & Co., Ltd., Ord.	5	7½-8
61,000	5	8/-	Do. 6% Cum. Pref.	5	5½-6
£900,000	Stk	4½%	Do. 4½% Deb. Stock, Rd.	100	106-108
233,334	1	6d.	Doulton & Co., Ltd., 5% Cum. Pref.	1	1½-1½
£233,334	Stk	4%	Do. 1st Mort. 4% Free Deb. Stk.	100	107-110
99,261	5	1/6	Edison and Swan United Electric Light, Ltd., "A" Shares Nos. 1-99,261	5	1½-1½
17,139	5	2/6	Do. "A" Shares Nos. 01-017,139	5	2-2½
£344,028	Stk	4%	Do. 4% Deb. Stock Rd.	100	84-89
£100,000	Stk	5%	Do. 5% Second Deb. Stk. Rd.	100	89-94
112,100	2	1/7½	Electric Construction Co., Ltd.	2	2-1½
31,390	2	2/9½	Do. 7% Cumulative Pref.	2	2½-2½
£200,000	Stk	4%	Do. 4% Perp. 1st Mt. Deb. Stk.	100	96-99
10,248	10	7/6	Evered and Co., Ltd.	10	11-13
£100,000	Stk	5%	Ferranti, Ltd., 5% 1st Mort. Deb. Stock, Rd.	100	90-95
25,000	10	5/-	Gen. Elec. Co. (1900), Ltd., 5% Cum. Pref.	10	9½-10½
£200,000	Stk	4%	Do. 4% 1st Mt. Deb. Stk. Rd.	100	97-101
35,000	5	10/-	Henley's (W. T.) Telegraph Works Co., Ltd., Ord.	5	11½-12½
35,000	5	2/3	Do. 4½% Cum. Pref.	5	5½-5½
£50,000	Stk	4½%	Do. 4½% Mt. Deb. Stk. Rd.	100	109-111
50,000	10	5/-	India Rubber, Gutta Percha & Telegraph Works Co., Ltd., Ord.	10	15½-16½
£300,000	100	4%	Do. 4% 1st Mort. Deb. Rd.	100	100-108
7,500	10	—	Parker, Thos., Ltd.	10	6½-7
100,000	1	3%	Scott (Ernest) & Mountain, Ltd., Ord.	1	16½-16/9
37,350	12	2½/-	Telegraph Construction and Maintenance Co., Ltd.	12	33-35
£150,000	100	4%	Do. 4% Deb. Bonds	100	103-105

III.—ELECTRIC TRACTION.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
120,000	5	5/-	Anglo-Argentine Trams Co., Ltd., Ord.	5	5½-5½
260,007	5	2/6	Do. 5% Cum. Pf.	5	6-6½
£230,000	Stk	6%	Do. Permanent 6% Debenture Stock, 1888	100	141-144
20,000	10	12/-	Barcelona Trams Co., Ltd., Ord.	10	12½-13½
10,000	10	5/-	Do. 5% Cum. Pf. Shares	10	9½-10½
£46,300	100	5%	Do. 5% Debs., Rd.	100	99-102
£191,326	Stk	4½%	Do. 4½% Red. Deb. Stk.	100	96-100
75,606	1	—	Bath Elec. Trams, Ltd., Pf. Or.	1	3-3½
59,394	1	11-1d	Do. 5% Cum. Pf.	1	1½-1½
75,000	5	—	Brisbane Electric Tram Investment Co., Ltd., Ord.	5	1-1½
75,000	5	2/6	Do. 5% Cum. Pf.	5	3½-4½
£425,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Rd.	100	94-98
£200,000	Stk	6%	Brit. Columbia Elec. Rly. Co., Ltd., Def. Ord. Stock	100	105-108
133,301	10	5/-	Do. 5% Pref. Ord. Stock	100	98-101*
156,497	10	6/-	Brit. Electric Traction, Ltd., Ord.	10	92-93
£1,000,000	Stk	5%	Do. 5% Cum. Pref.	10	11½-11½
£250,000	Stk	4½%	Do. 5% Perp. Deb. Stk.	100	122-124
100,000	5	2/6	Do. 4% 2nd Deb. Stk. Rd.	100	97-99
40,500	5	3/-	Buenos Ayres & Belgrano Electric Trams, Ltd., Ord.	5	3½-3½
27,000	5	3/-	Do. "A" 6% Cum. Pref.	5	5½-5½
			Do. "B" do.	5	5½-5½

ELECTRIC TRACTION.—Contd.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£200,000	Stk	5%	Buenos Ayres Elec. Trams Co. (1901) Ltd., 5% Db. Stk., Rd.	100	97-99
£220,000	100	6%	Buenos Ayres Gd. Nat., Ltd., 6% 1st Deb. Bds.	100	101-105
102,268	5	5/-	Calcutta Tramways Co., Ltd.	5	8½-8½
£350,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Rd.	100	107-109
480,000	1	6d.	Cape Electric Tramways, Ltd.	1	12-14
40,000	5	2/6	City of Birmingham Trams Co., Ltd., 5% Cum. Pref.	5	4½-5½
£300,000	100	4%	Do. 4% 1st Mort. Debs.	100	99-102
£120,000	Stk	5%	Colombo Elec. Tram. & Light. Co., Ltd., 5% 1st Mort. Deb. Stk. Rd.	100	101-103
60,000	10	6/-	Dublin United Trams Co. (1896), Ltd., Ord.	10	13½-14½
59,987	10	6/-	Do. 6% Pref.	10	15-16
30,000	5	2/6	Iale of Thanet Elec. Trams. and Light. Co., Ltd., 5% Cum. Pref.	5	8-8½
£150,000	Stk	4%	Do. 4% Deb. Stock	100	85-90
125,000	10	5/-	London United Trams (1901), Ltd., 5% Cum. Pref.	10	10-10½
£1,031,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Rd.	100	99-102
£50,000	Stk	5%	Madras Electric Trams (1904), Ltd., 5% Deb. Stock, Rd.	100	101-103
814,016	1	—	Metropolitan Elec. Trams, Ltd., Def.	1	1½-1½
500,000	1	6d.	Do. 5% Cum. Pref.	1	1-1½
£350,000	Stk	4½%	Do. 4½% Deb. Stock, Rd.	100	106-108
50,000	5	6/-	New General Traction Co., Ltd., 6% Cum. Pref.	5	3-1½
110,923	8	3/2d	North Metropolitan Tramways Co., Ltd., 3½% Mort. Debs.	8	4½-5
£150,000	100	8½%	Do. 8½% Mort. Debs.	100	90-95
£196,200	Stk	5%	Perth Electric Trams, Ltd. (W.A.) 5% 1st Mort. Deb. Stock, Rd.	100	105-108
24,500	10	10/-	Potteries Elec. Traction Co., Ltd., Ord.	10	6½-9½
24,500	10	5/-	Do. 5% Cum. Pref.	10	9½-9½
£220,000	Stk	4½%	Do. 4½% Deb. Stk., Rd.	100	101-104

IV.—ELECTRIC LIGHTING AND POWER.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
7,500	10	14/-	Bournemouth & Poole Elec. Sup. Co., Ltd., Ord.	10	11½-12½
7,500	10	4/6	Do. 4½% Cum. Pref.	10	10-10½
7,500	10	6/-	Do. 6% Cum. Second Pf.	10	11-12
£70,000	Stk	4½%	Do. 4½% Deb. Stock Rd.	100	107-109
14,000	5	3/6	Bromley (Kent) Elec. Lt. & Pr. Co. Ltd.	5	5½-5½
£50,000	Stk	4½%	Do. do. 4½% 1st Deb. Stk. Rd.	100	102-105
27,507	5	5/6	Brompton & Kensington Elec. Supply Co., Ltd., Ord.	5	9½-10½
12,493	5	3/6	Do. 7% Cum. Pref. Shares	5	9½-10½
50,000	5	5/-	Calcutta Elec. Sup. Cor. Ltd., Ord.	5	8½-9½
£238,782	Stk	4%	Central Elec. Sup. Co., Ltd., 4% Gns. Deb. Stk.	100	103-106*
70,000	5	4/-	Charing Cross & Strand Elec. Sup. Corp., Ltd., Ord.	5	7½-8½
80,000	5	2/3	Do. do. 4½% Cum. Pref.	5	5½-5½
£350,000	Stk	4%	Do. do. 4½% Deb. Stk. Rd.	100	106-108
41,336	5	3/9	Chelsea Elec. Sply. Co., Ltd., Ord.	5	6½-6½
£150,000	Stk	4½%	Do. do. 4½% Deb. Stk., Rd.	100	109-111
70,595	10	7/-	City of London El. Light. Co., Ltd., Ord.	10	10½-11½
40,000	10	6/-	Do. 6% Cum. Pref.	10	14-14½
£400,000	Stk	5%	Do. 5% Deb. Stk., Rd.	100	124-128
£300,000	Stk	4½%	Do. 4½% 2nd Deb. Stk., Rd.	100	104-106
40,000	10	5/-	County of London Elec. Supply Co., Ltd., Ord.	10	8½-9
30,000	10	6/-	Do. 6% Cum. Pref.	10	12-12½
£400,000	Stk	4½%	Do. 4½% Deb. Stk., Rd.	100	118-116
70,000	5	2/6	Edmundson's Elec. Cor. Ltd., Ord.	5	5½-6½
70,000	5	3/-	Do. 5% Cum. Pref.	5	6-6½
£300,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Rd.	100	107-109
£30,000	Stk	5%	Electric Lighting & Traction Co. of Australia, Ltd., 5% Deb. Stk. Rd.	100	86-91
10,000	5	7/6	Folkestone Elec. Supply Co., Ltd., O.	5	6½-5½
£50,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Rd.	100	101-104
15,000	10	—	Havana Electricity Co., Ltd.	10	9½-10½
13,000	5	5/-	Hove Elec. Lighting Co., Ltd., Ord.	5	7½-8½
£50,000	Stk	4½%	Isle of Wight Electric Light & Power Co., Ltd., 4½% Deb. Stock, Rd.	100	100-103
150,000	1	—	Kalgoorlie Electric Power & Lighting Corp. Ltd., 5% Cum. Pref.	1	3-7
21,000	5	7/-	Kensington and Knightsbridge Electric Lighting Co., Ltd., Ord.	5	11½-12½

Stocks and Shares marked * are quoted ex-dividend.

ELECTRIC LIGHTING AND POWER.—Contd.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£185,000	Stk	4%	Kensington and Knightsbridge Electric Lighting Co., Ltd., and the Notting Hill Electric Lighting Co., Ltd., 4% Deb. Stock, Red.	100	101-108
111,000	8	1 9/8	London Elec. Supply Corp., Ltd., Ord.	8	2-24
60,000	5	3/-	Do. 6% Pref.	5	5-54
£871,895	Stk	4%	Do. 4% 1st Mort. Deb. Stk., Red.	100	99-101
100,000	10	11/-	Metropolitan Elec. Sup. Co., Ltd., Ord.	10	98-104
76,121	5	2 3/8	Do. 4 1/2% Cum. Pref.	5	54-58
220,000	Stk	4 1/2%	Do. 4 1/2% 1st Mort. Deb. Stk., Red.	100	111-115
250,000	Stk	4 1/2%	Do. 3 1/2% Mort. Deb. Stk., Red.	100	98-100
£250,000	—	4 1/2%	Midland Elec. Corp. for Power Distribution, Ltd., 4 1/2% 1st Mort. Deb.	100	99-101 1/2
10,852	10	3/-	Notting Hill Elec. Ltg. Co. Ltd., Ord.	10	142-152
£29,000	100	4%	Do. 4% 1st Mort. Debs.	100	100-102
16,500	5	4/6	Oxford Electric Co. Ltd., Ord.	5	64-7
£50,000	Stk	4%	Do. 4% Debenture Stk., Red.	100	99-101
£84,700	100	4 1/2%	Royal Elec. Co. (of Montreal) 4 1/2% 20-yr. 1st Mort. Deb.	100	101-104
40,000	5	9/6	St. James' & Pall Mall Elec. Light Co., Ltd., Ord.	5	133-142
20,000	5	3/6	Do. 7% Pref.	5	8-9
£150,000	Stk	8 1/2%	Do. 3 1/2% Deben. Stock, Red	100	98-100
12,000	5	4/-	Smithfield Markets Elec. Supply Co., Ltd., Ord.	5	28-34
£50,000	Stk	4%	Do. 4% Debenture Stk., Red.	100	79-83
65,000	5	4/-	South London Elec. Sup. Co., Ltd., O.	5	82-42
100,000	1	—	South Metropolitan Elec. Light & Power Co., Ltd., Ord.	1	14-42
50,000	1	8 1/2d.	Do. 7% Cum. Pref.	1	1 1/2-1 1/4
£100,000	Stk	4 1/2%	Do. 4 1/2% 1st Deb. Stock, Red.	100	105-108
50,000	5	2/6	Urban Electric Supply Co., Ltd., O.	5	42-54
30,000	5	2/6	Do. 5% Cum. Pref.	5	54-58
£200,000	Stk	4 1/2%	Do. 4 1/2% 1st Mort. Deb. Stk., Red.	100	104-106
110,000	5	7/6	Westminster Elec. Supply Corp., Ltd., Ord.	5	12-18
28,151	5	2/6	Do. 5% Cum. Pref.	5	62-64

V.—TELEGRAPH & TELEPHONE COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£24,800	100	4%	African Direct Tel. Co., Ltd., 4% Mt. Debs. (Series A), Red.	100	100-103
25,000	10	—	Amazon Telegraph Co., Ltd.	10	24-23
£768,580	Stk	15/-	Anglo-American Tel. Co., Ltd., Ord.	100	59-61
£3,118,210	Stk	80/-	Do. 6% Preferred Ordinary	100	105-106
£3,118,210	Stk	2/-	Do. Deferred Ordinary	100	154-152
44,000	5	3/-	Chili Telephone Co., Ltd.	5	68-64
£15,000,000	£100	32	Commercial Cable Co., Capital Stk.	100	97 1/2-99 1/2
£1,908,856	Stk	4%	Do. Sterl. 500-yr 4% Deb. Stk., Red.	100	8-84
16,000	10	5/-	Cuba Submarine Tel. Co., Ltd., Ord.	10	16-17
6,000	10	10/-	Do. 10% Preference	5	38-38
6,000	5	5/-	Direct Spanish Telegraph Co., Ord.	5	24-9
£30,000	50	4 1/2%	Do. 10% Cum. Preference	50	101-108 1/2
60,710	20	3/-	Direct U.S. Cable Co., Ltd.	20	11 1/2-11 1/2
£25,800	100	4 1/2%	Direct West India Cable Co., Ltd., 4 1/2% Reg. Debs.	100	100-102
£300,000	100	4%	East. & S. African, Ltd., 4% Mt. Dbs.	100	100-102
£300,000	25	4%	Do. 4% Rg. Mt. Dbs. (Mauritius Subsidy)	25	100-102 1/2
800,000	10	2/6	Eastern Extension, Australasia and China, Ltd.	10	132-142
£602,400	Stk	4%	Do. 4% Mort. Deb. Stk., Perp.	100	105-107
£4,000,000	Stk	25/-	Eastern Tele. Co., Ltd., Ord.	100	141-144
£2,000,000	Stk	17/6	Do. 8% Pref.	100	90-92
£1,886,814	Stk	4%	Do. 4% Mort. Deb.	100	107-109
150,000	10	5/-	Great Northern Telegraph Co., Ltd., (of Copenhagen)	10	33 1/2-34 1/2
£58,700	100	4 1/2%	Halifax and Bermudas Cable Co., Ltd., 4 1/2% 1st Mort. Debs. Red.	100	101-103
17,000	25	12/6	Indo-European Tele. Co., Ltd.	25	49-51
72,680	1	7 1/2d.	Monte Video Telephone Co., Ltd., O.	1	3-4
£1,983,393	Stk	6%	National Telephone Co., Ltd., Pref.	100	111-112
£1,966,667	Stk	5%	Do. Deferred	100	102-104
250,000	5	2/6	Do. 5% Non-Cum. 3rd Pref.	5	54-54
£260,000	Stk	3 1/2%	Do. 3 1/2% Deb. Stk., Red.	100	100-102
£289,593	Stk	4%	Do. 4% do. do.	100	103-105
179,313	1	8 1/2d.	Oriental Telephone & Elec. Co., Ltd.	1	14-12
50,000	1	7 1/2d.	Do. 6% Cum. Pref.	1	14-14 1/2
£100,000	100	4%	Pacific & European Tel. 4% Guar. Debs. Red.	100	99-102
11,889	5	4/-	Reuter's Telegram Co., Ltd.	8	74-8*
55,000	5	3/-	United River Plate Tele. Co., Ltd.	5	62-7 1/2
40,000	5	2/6	Do. 5% Cum. Pref.	5	5-5 1/2
£179,947	Stk	5/-	Do. 5% Deb. Stock, Red.	100	108-110
15,609	10	4/-	W. African Telegraph Co., Ltd.	10	8-8 1/2
£20,038	2 1/2	—	West Coast of America, Ltd.	2 1/2	2-2
150,000	100	4%	Do. 4% Deb. Guar. by West. Tel.	100	100-102

TELEGRAPHS AND TELEPHONES.—Contd.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
88,321	10	6d.	W. India & Panama Teleg. Co., Ltd., Or.	10	4-8
84,568	10	6/-	Do. 6% Cum. 1st Pref.	10	7-7 1/2
4,669	10	6/-	Do. 6% Cum. 2nd Pref.	10	52-53
£80,000	100	5%	Do. 5% Deb.	100	104-106
207,930	10	3/-	Western Telegraph Co., Ltd.	10	134-14
£75,000	100	5%	Do. 5% Debs., 2nd Series, 1906	100	101-102
518,915	Stk	4%	Do. 4% Deb. Stock, Red.	100	103-105

VI.—SHIPPING COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
32,500	10	5/6	Anchor Line (Henderson Bros.), Ltd., 5 1/2% Cum. Pref.	10	82-92
£325,000	Stk	4 1/2%	Do. 4 1/2% Red. 1st Mort. Deb. Stk.	100	99-101
£672,900	Stk	4 1/2%	British & African Ste. Nav. (1900) Ltd., 4 1/2% 1st Mort. Deb. Stk., Red.	100	97-99
40,000	10	5/6	Bucknall Steamship Lines, Ltd., 5 1/2% Cum. Pref.	10	52-64
£600,000	Stk	4 1/2%	Do. 4 1/2% 1st Mort. Deb. Stk.	100	87-91
£750,000	Stk	4 1/2%	Clan Line Steamers, Ltd., 4 1/2% Deb. Stk., Red.	100	101-103
60,000	20	18/-	Cunard Steam Ship Co., Ltd., Nos. 1-60,000	20	12-12
40,000	20	8/-	Do. Nos. 60,001-100,000	10	43-5 1/2
£461,430	Stk	4 1/2%	Elder Dempster Shipping, Ltd., 4 1/2% 1st Mort. Deb. Stk.	100	100-102
1,200,000	1	6d.	Furness, Withy & Co., Ltd., Ord.	1	1 1/2-1 1/2
25,328	7 1/2	4/7	Gen. Steam Navigation Co., Ltd., Ord.	7 1/2	5-5 1/2
36,758	8	4/9 1/2	Do. Non-Cum. 6% Pref.	8	8-8 1/2
£150,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk., Red.	100	100-102
55,000	5	1/8	Houlder Line, Ltd., Ord.	5	24-24
40,000	5	2/9	Do. 5 1/2% Cum. Pref.	5	3-3 1/2
£200,000	Stk	4 1/2%	Do. 4 1/2% 1st Mt. Deb. Stk., Red.	100	88-90
141,500	10	5/-	Leyland (Frederick) & Co., (1900), Ltd., 5% Cum. Pref.	10	4-4 1/2
£1,160,000	Stk	5%	Peninsular and Oriental Steam Nav. Co., 5% Cum. Pref.	100	129-132 1/2
£1,160,000	Stk	19%	Do. do. Deferred	100	223-228 1/2
15,000	100	30/-	Royal Mail Steam Packet Co. Ord.	60	90-91
39,075	5	2/6	Shaw, Savill & Albion, Ltd., 5% Cum. "A" Pref.	5	4 1/2-5 1/2
39,075	5	2/6	Do. "B" Ord.	5	4-4 1/2
141,841	10	4/-	Union Castle Mail Steamship Co., Ltd., Ord.	10	82-83
24,000	10	4/6	Do. 4 1/2% Cum. Pref.	10	102-104
£1,008,894	Stk	4%	Do. 4% Debenture Stk., Red.	100	102-104

VII.—MISCELLANEOUS COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
60,000	1	93d.	Chadburn's (Ship) Teles. Ltd., Ord.	1	1 1/2-1 1/2
£750,000	Stk	9%	General Hydraulic Power Co., Ltd.	100	127-132
12,500	10	10/-	Oakey (John) and Sons, Ltd., Ord.	10	24-26
10,000	10	6/-	Do. do. 8% Cum. Pf.	10	14-15
183,538	1	6 3/4d.	Power Gas Corp., Ltd., Ord., Nos. 66,469-250	15/-	1 1/2-1 1/2
66,462	1	8 1/4d.	Do. do. Nos. 1-66,462	1	1 1/2-1 1/2
135,000	1	6d.	Waygood (R.) & Co., Ltd., Ord.	1	14-14 1/2
135,000	1	7 1/2d.	Do. 6% Cum. Pref.	1	14-12

RAILWAY CARRIAGE & WAGON COMPANIES.

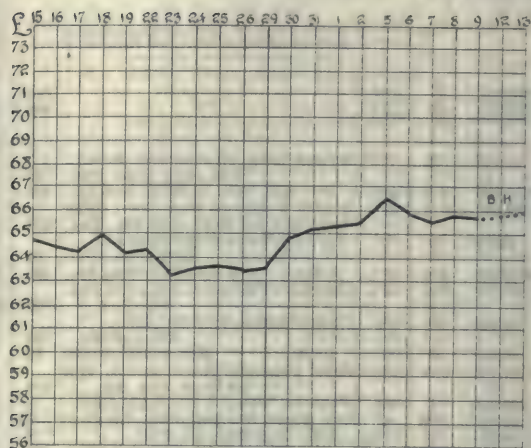
Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
10,000	10	7/6	Birm. Railway-Car. & Wagon, L., 1-10,000	10	22 1/2-23
8,739	10	3/-	Do. Second Issue 1-8,739	4	82-92
10,000	10	6/-	Do. Cum. Pref. 6% 1-10,000	10	18-13 1/2
80,111	7	7/-	Gloucester Rail.-Car & Wagon, Ltd., A, 1-29,861 & 49,751-50,300	7	9 1/2-9 1/2
44,889	7	3/6	Do. B, 29,862-49,750, 50,001-75,000	7	42-4
14,567	10	1/3	Lancashire Wagon, Ord.	2	28-28
4,150	10	5%	Do. do.	10	104-102
784,808	1	9d.	Metropolitan Amalgamated Rail.-Carriage & Wagon, Ltd., 1-784,808	1	4 1/2-4 1/2
164,288	1	6d.	Do. Cum. A Pref. 5% 1-164,288	1	23/6-24/6
285,000	1	7 1/2d.	Do. Cum. B Pref. 6% 1-285,000	1	27/6-28
20,000	20	20/-	Midland Rail.-Car. & Wagon, L., 1-20,000	10	19-19 1/2

Stocks and Shares marked * are quoted ex-dividend.

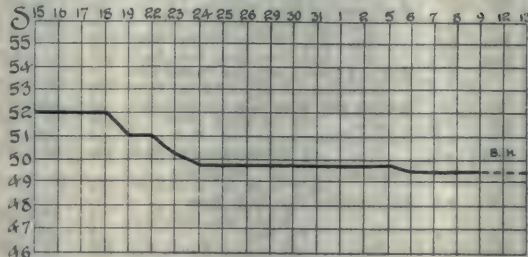
THE HOME METAL MARKET.

SHOWING DAILY FLUCTUATIONS FROM MAY 15TH TO JUNE 13TH, 1905.

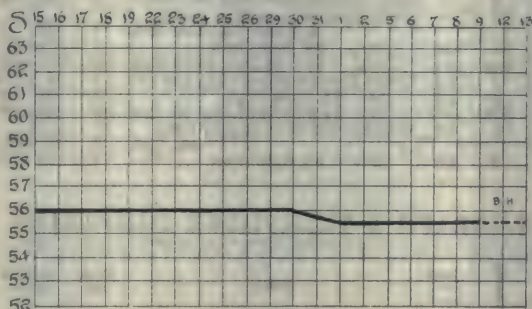
COPPER.



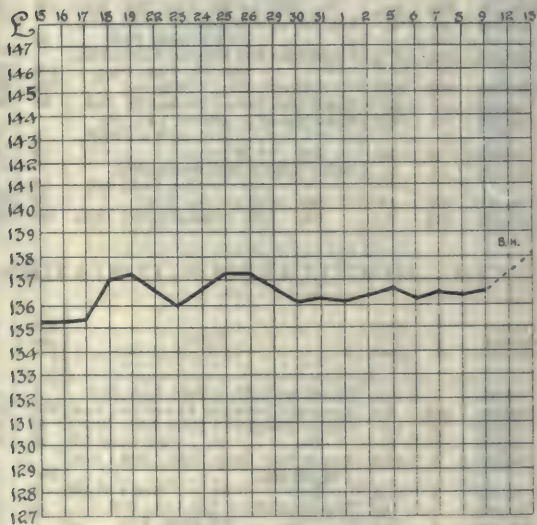
PIG IRON: SCOTCH,



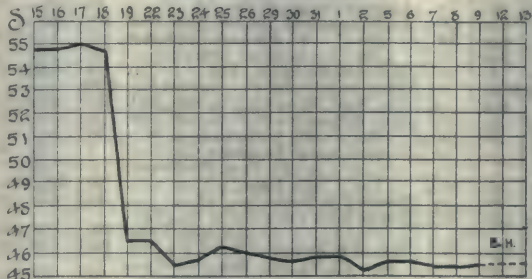
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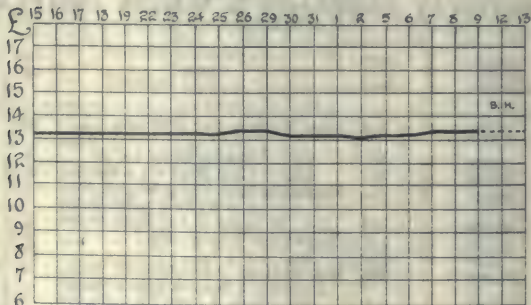
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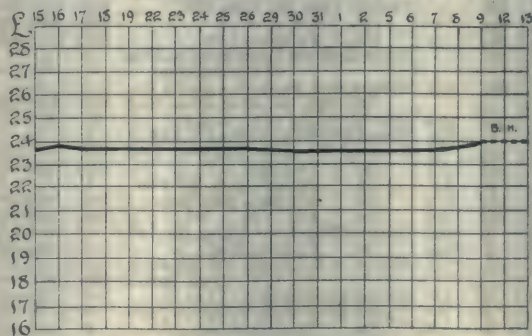
CLEVELAND.



ENGLISH LEAD.



SPELTER.



PRICES CURRENT OF COAL, IRON, STEEL, AND OTHER METALS.

MANUFACTURERS' AND MERCHANTS' QUOTATIONS.

MARKET REPORT.

Wednesday, June 14th, 1905.

THE improvement in the Copper position has continued, the heavy covering orders by the bear party, to which reference was made in this column last week, having materially assisted in raising quotations. The eve of the holidays saw some slackening of the demand, and as this was coincident with less favourable advices from Wall Street, quotations re-acted, but with the recrudescence of peace prospects the tendency improved again, and to-day's closing price is £66 for all positions.

The Tin market has been left practically in the hands of professional operators, who, not being inclined to commit themselves to any decided course of action, have been keeping the metal in a dormant condition. It is pointed out by Merton and Co.'s circular that the prospects of this market depend almost entirely upon the future development of the tinplate industry in the United States. Considerable activity is anticipated in the autumn months, and there is steady support for the forward position. The quotation has rallied to £137 10s. cash.

Supplies of lead have been somewhat restricted, and the market is rather bare, so that consumers have had to pay somewhat higher prices for their requirements, fine foreign being quoted at £13 for prompt delivery, with English at £13 2s. 6d.

A decided revival is to be noted in the Spelter market, and the large exports of galvanised iron for May are a reflex of the excellent consumption in this country, while reports from the Continent also indicate scarcity of stocks and good trading. Those best qualified to form an opinion believe that the demand will increase, and that we shall see higher prices for Spelter in the immediate future. As it is, the market closes firm with an advance of about 7s. 6d.

For the first time since the collapse of the corner in Cleveland warrants, stocks show a tendency to decrease, owing to an improvement in the demand on contract requirements. Prices, however, have fluctuated very little, and Cleveland closes practically unaltered at 45s. 6d. for cash delivery, although a small rise in standard foundry iron is to be noted. Reports from the United States are not very favourable, but the consumption of pig iron in Europe is on the increase.

IRON, STEEL, PIG- IRON, &c.

SCOTLAND.

Messrs. David Colville and Sons, Ltd., Dalzell Steel and Iron Works, Motherwell, N.B., quote as follows. Prices delivered in Glasgow or equal :—

Steel :		£	s.	d.
 Dalzell	Siemens' Steel Plates, Marine Boiler Quality ..	6	15	0
 Dalzell	" " " Land " " ..	6	17	6
 Dalzell	" " Steel Bars, Boiler Quality	6	17	6
 Dalzell	Siemens' Steel Plates, Ship Quality Plates.....	5	17	6
 Dalzell	" " Bars " "	6	7	6
 Dalzell	" " Angles.....	5	7	6

Manufactured Iron :

Bars—Dalzell.....	6	2	6
" Best	6	12	6
" " Horseshoe	6	12	6
" Angle.....	6	2	6
" Best Angle	6	12	6
" Best Best	7	2	6
" Extra Best	7	12	6

Usual terms and extras. Special rates for delivery in England and export. The above prices subject to alteration without notice.

The Glasgow Iron and Steel Co., Ltd., Wishaw, quote as under (prices are delivered Glasgow or equal) :—

Steel Angles (Glasgow  Steel)	£	s.	d.	per ton.
5 7 6				
Steel Ship Plates (Glasgow  Steel)	5	17	6	"
Steel Bars, Ship Quality (Glasgow  Steel)	6	7	6	"
Steel Bars, Boiler Quality (Glasgow   Steel)	6	17	6	"
Steel Land Boiler Plates (Glasgow   Steel)	6	7	6	"
Steel Marine Boiler Plates (Glasgow   Steel)	6	7	6	"

Less 5 per cent. discount. Extras as per standard list.

Special prices for delivery in England and for export. The above prices subject to alteration without notice.

John Spencer (Coatbridge), Ltd., Phoenix Iron works, Coatbridge, N.B., quote :—

Bars—Phoenix	£	s.	d.
" Best	6	5	0
" Best Best	6	15	0
" Extra Best.....	7	5	0
" Best Horse Shoe	7	15	0
" Extra B.H.S.	6	15	0
" Extra Best Cable	7	15	0
" Rivet	8	5	0
" Best Scrap Rivet	6	5	0
"	7	5	0

Angles—Phoenix	£ s. d.
Best	6 5 0
Extra Best	7 5 0

Gas Tube Hoops—Phoenix Best	6 15 0
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Plates—Phoenix	£ s. d.
Best Boiler	7 10 0
Best Best Boiler	8 0 0
Extra Best Boiler	9 0 0

Boiler Tube Strips—Phoenix Best Best	8 0 0
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All per ton, delivered f.a.s., Glasgow, Greenock, Grangemouth, Granton, Leith, or Ardrossan. 5 per cent. discount cash monthly.

Messrs. R. Feldtmann and Co., of Glasgow, quote Commission extra).

Pig Iron :	No. 1.	No. 3.
	£ s. d.	£ s. d.
Coltness, f.a.s. Glasgow.....	3 8 6	2 14 0
Gartsherrie.....	2 17 0	2 13 6
Summerlee.....	2 17 6	2 13 6
Carnbroe.....	2 14 6	2 13 0
Langloan.....	8 0 0	2 15 0
Calder.....	2 18 0	—
Clyde.....	2 17 0	2 13 0
Glengarnock, f.o.b. Ardrossan.....	2 18 0	2 13 0
Eglinton.....	2 14 0	2 12 0
Dalmellington, „ Ayr.....	—	2 12 0
Shotts..... „ Leith.....	2 18 0	2 13 6

NORTH OF ENGLAND.

Messrs. W. Whitwell and Co., Ltd., Thornaby Ironworks, Stockton, quote as follows, at works:—

	£ s. d.
W.W.  Bars	6 12 6
W.W. Best Bars	7 2 6
W.W. Best Best	7 12 6
W.W. Best Best Best	8 2 6
W.W. Best Shoe	7 2 6
Thornaby 	8 2 6
Thornaby Best.....	8 12 6
Thornaby Best Best	9 12 6
Whitwell Special Admiralty Cable	10 5 0
Special Chain Iron	9 5 0
Tube and Nail Strips	6 15 0
W.W.  Angle Iron	6 15 0
W.W. Best Angle Iron	7 5 0
Tee Iron, to 8-inches United.....	7 12 6

Terms, Cash, less 2½ per cent. discount on 10th of month following delivery.

LANCASHIRE.

The Pearson and Knowles Coal and Iron Company, Ltd. Dallam and Bewsey Forges, Warrington, quote:—

	Iron.	Steel.
	£ s. d.	£ s. d.
 Bars	6 10 0	6 15 0
 Angles	7 0 0	7 5 0
 Tees	7 10 0	7 15 0
 Hoops	7 0 0	7 10 0
W.I.W. Sheets	7 10 0	8 0 0

Ordinary Sizes, F.A.S. Liverpool in 10-ton Lots.
Extras for Sizes and Cutting as per List.

WORCESTERSHIRE.

Baldwins Ltd. (with which is amalgamated Knight and Crowther, Ltd.), Wilden Works, near Stourport, quote:—

	Singles 20 G 96in. by 86in. per ton.	Doubles 21 G to 24 G 96in. by 86in. per ton.
Black Sheets:	£ s. d.	£ s. d.
"Vale"	10 0 0	10 10 0
"Shield"	10 10 0	11 10 0
"Severn"	11 10 0	12 10 0
"Baldwin Wilden B."	12 10 0	13 10 0
Charcoal.....	16 10 0	17 10 0
Best Charcoal.....	18 10 0	19 10 0

Pickled, cold-rolled and close annealed sheets specially quoted for.

Extra widths, Singles to 66in., Doubles to 56in., Lattens to 46in.
Extra lengths, Singles to 168in., Doubles to 132in., Lattens to 108in.

Patent Coated Sheets:

	£ s. d.	£ s. d.
No. 3 Lead.....	13 10 0	14 10 0
S.V. Lead	15 0 0	16 0 0
No. 3 Terne	15 0 0	16 0 0
S.V. Terne.....	16 10 0	17 10 0

	Singles 20 G to 108 by 86in. per ton.	Doubles 21 to 24 G to 96 by 86in. per ton.
Tinned Sheets:	£ s. d.	£ s. d.
Best Coke (Finish)	29 0 0	30 10 0
Charcoal (Finish)	31 0 0	32 10 0
Extra „ „	33 0 0	34 10 0

Cotton Can Tin Sheets to 39in. by 36in. specially quoted for.
Tin Plates, "Cookley, K" Best Charcoal, £1 7s. 0d. per box.
Extreme sizes in Tin and Patent Coated specially quoted for.
Lattens up to 36 wide by 27 W.G. £1 10s. 0d. per ton extra
throughout for all brands.
At works.

Galvanized Corrugated Sheets:

	£ s. d.
"Phoenix" Brand, 24 G., f.o.b. London, in Bundles	11 15 0 per ton.
"Blackwall" Brand, 26 G., in felt-lined cases for Australia, f.o.b. London.....	14 5 0 „

Galvanized Working Up-Sheets:

	£ s. d.
24 G., f.o.b. London, in Bundles	13 0 0 per ton.

STAFFORDSHIRE.

Shelton Iron, Steel, and Coal Co., Ltd., Stoke-on-Trent, North Staffordshire, and 122, Cannon Street, London, quote:—

	£ s. d.
Crown Bars.....	6 10 0 per ton.
Best Bars (1 to 6in. wide, above ½ in. thick, ½ in. to 4 rounds and squares)	7 0 0 „
Angles	6 15 0 „
„ Best	7 5 0 „
T's	7 0 0 „
„ Best	7 10 0 „
Best Shoe Iron	8 0 0 „
„ Rivet Iron	8 0 0 „
„ Best Rivet (Special)	9 5 0 „
„ Cable	9 5 0 „
„ Screwing	8 5 0 „

	£	s.	d.	
Best Turning	8	0	0	per ton.
„ Plating.....	8	5	0	„
Best Best.....	9	5	0	„
Treble Best.....	10	5	0	„
Plates	7	10	0	„
Best Plates	8	0	0	„
„ Boiler Plates	8	10	0	„
„ Best Boiler Plates	9	10	0	„
Treble Best Boiler Plates	12	0	0	„

Delivery f.o.b. Liverpool, Birkenhead or Manchester.

WALES.

Cordes (Dos Works), Ltd., of Newport, Mon.,
quote "Star" brand patent wrought nails steel nails, &c.

Discounts—

45 per cent. off 1-inch to 3-inch strong rose and all fine rose and 8dy. and 8dy. pound.

40 per cent. off 3½ inch to 7-inch strong rose and 10dy. and 20dy. pound.

40 per cent. off all sharp-pointed nails.

Delivered in lots of 4 cwt. and upwards. Extra 2½ per cent. discount off the gross on two tons and upwards.

Steel rose, flat points, 5-inch to 7-inch basis:—

2 tons 9/6 per cwt. } d/d any Railway Station.
4 cwt. lots and upwards 9/9 per cwt. }

Steel cut nails, 3-inch basis—

2 tons 8/3 per cwt. }

4 cwt. lots 8/6 per cwt. } d/d any Railway Station.

Slit rods (iron) £7 10s. per ton, at works for 2-ton lots.

Messrs. Richard Thomas and Co., Ltd., of 33 and 35, Eastcheap, E. C. — Works: South Wales, Burry, Lydney, Lydbrook, and Cwmbwrla,
quote:—

Per Box.
f.o.b.
Wales.

Coke Tin-plates.	£	s.	d.
C 18½ by 14 124s. 110 lb. "BV"	0	12	0
C 20 by 10 225s. 155 „ "Jumbo"	0	17	0
C 20 by 14 112s. 108 „ "Lydbrook"	0	11	9
C 28 by 20 112s. 216 „ "Lydbrook"	1	3	9

Charcoal Tinplates:

C 20 by 14 112s. 108 lb. "Allaway" 0 12 6

BELGIUM.

C. L. Faulkner, Suffolk House, Laurence Pountney Hill, London, E.C., quotes:—

Prices quoted are in £ stg. and per ton of 1,015 kos. (2,240 lb.) delivered free on board ANTWERP for approved quantities.

Steel:	£	s.	d.
Blooms	at 3	16	0 per ton.
Billets	at 3	18	0 „
Sheet Bars	at 4	0	0 „

Finished Steel:

Bars	at 5	2	0 per ton.
Angles	at 5	3	0 „
Tees	at 5	6	0 „
Joists	at 4	10	0 „
Fencing Standards	at 5	3	6 „
Shoeing Bars	at 5	5	0 „
Tyre Bars	at 5	5	0 „
Half-Round Bars	at 5	10	0 „
Heavy Rails	at 5	5	0 „
Light Rails	at 4	17	6 „

Structural Steelwork:

Prices on application.

METALS.

Messrs. French and Smith, 147, Leadenhall Street, and 11, Oldhall Street, Liverpool, quote:—

TIN.

Tin:	£	s.	d.	£	s.	d.
English Ingots, f.o.b.	138	0	0	to 138	10	0 per ton.
Dis. 1¼% & 1%	139	0	0	to 139	10	0 „
English Bars, f.o.b.	139	0	0	to 139	10	0 „
Dis. 1¼% & 1%	138	2	6	to 138	5	0 „
Straits G.M.B., cash	136	15	0	to 136	17	6 „
Warehouse, Net						Nominal.
Straits G.M.B., 3 months,						
Warehouse, Net						
Australian, Mt. Bischoff,						
Warehouse, Net						

COPPER.

Copper:	£	s.	d.	£	s.	d.
Standard G.M.B., cash	65	2	6	to 65	5	0 per ton.
Warehouse, Net	65	0	0	to 65	2	6 „
Standard G.M.B., 3 months, Warehouse, Net.....	69	15	0	to 70	5	0 „
English, Tough, Cake & Ingot, Warehouses, Net.....	70	10	0	to 71	0	0 „
English, Best Select, Warehouse Net	79	0	0	to 80	0	0 „
English, Sheets and Sheathing, f.o.b., Dis. 2¼%	76	0	0	to 77	0	0 „
English, Sheets for India, f.o.b., Dis. 2¼%	69	5	0	to 69	10	0 „
Electro, Warehouse, Net .	0	12	0	to 0	13	0 per unit.
Ore, ex ship	18	0	0	to 0	13	7½ „
Regulus, Matte and Precipitate, ex ship,						

YELLOW METAL.

Yellow Metal:	£	s.	d.
Sheets, 4 by 4 feet for			
India f.o.b. Dis. 2¼%	0	0	6½ per lb.
Sheathing „ „	0	0	6½ „

SPELTER.

	£	s.	d.	£	s.	d.
Silesian outports, Net	23	12	6	to 23	15	0 per ton.
Blende of 50 % Net	6	11	6	to 6	12	6 „
Calamine, Net	6	14	0	to 6	15	0 „

LEAD.

	£	s.	d.	£	s.	d.
English Pig, Warehouse, Dis. 2¼%	13	5	0	to 13	7	6 per ton.
Spanish, ex ship, Dis. 2¼%	13	2	6	to 13	5	0 „
Lead Ore of 70 %, Net.....	6	8	0			

ANTIMONY.

	£	s.	d.	£	s.	d.
Star Regulus, f.o.b., Dis. 2¼%	45	0	0	to 47	0	0 per ton.
Ore, 50 %, ex ship, Dis. 2¼%	16	0	0	to 16	10	0 „
Crude, ex ship, Dis. 2¼%	29	0	0	to 30	0	0 „

QUICKSILVER.

	£	s.	d.
Spanish, 75 lb., Warehouse, Net.....	7	7	6 per flask.
Italian „ „ „	7	5	6 „

COAL.**LEICESTERSHIRE.**

The Nailstone Colliery Company, Leicester,
quote. Price per Ton at Pit of 20 Cwt., with $\frac{1}{4}$ Cwt. per
Ton for wastage —

Upper Main Seam.	s. d.
Main Coal	6 0
Best Hard Steam (hand picked, as used by the Railway Companies)	5 6
Best Hard Steam Cobbles (made through 6 in. mesh, free from slack)	5 8
Fine Slack	0 6

Terms, net cash on 10th of month following delivery.

DERBYSHIRE.

The Manners Colliery Co., Ltd., of Ilkeston
quote as follows, per ton at pit:

Kilburn Coal:	s. d.
Best London Brights	9 9
Large Nuts ($1\frac{1}{2}$ to $3\frac{1}{2}$)	9 6
Small Nuts ($\frac{3}{4}$ to $1\frac{1}{2}$)	6 0
Rough Brights	6 0
Peas ($\frac{3}{4}$ to $\frac{1}{2}$)	5 0
Slack	3 6
Smudge	2 0

Low Main (or Tupton) Coal:

Low Main Brights	7 6
" " Nuts	7 3
Hards (Good Steam Coal)	8 0
Bakers' Nuts ($1\frac{1}{4}$ to $2\frac{1}{4}$)	6 6
Slack	3 6

The Clay Cross Company's Collieries, Clay Cross,
near Chesterfield, quote:—

	per ton at pit.
	s. d.
Best Main Coal	10 6
Best Silkstone	10 0
Best House Coal	8 6
Best House Nuts	8 0
Treble Screened Cobbles	7 9
Best Cobbles	7 3

NOTTINGHAMSHIRE.

The Digby Colliery Co., Ltd., near Nottingham,
quote per ton at pit:—

Digby Coal:

STEAM.	s. d.
Best Hand Picked Hard	8 6
Steam Hard	7 3
Hard Nuts	6 6

Gedling Colliery.**HIGH HAZEL.**

London Brights, 4 to 8 in. cube	9 6
Bright Cobbles (Hand Picked)	9 0
Large Nuts, 2 to 4 in. cube	8 0
Small Nuts, 1 to 2 in. cube	6 0
Pea Nuts, $\frac{3}{4}$ to 1 in. cube	5 0

STEAM.—TOP HARD.

Best Hard	8 6
Hard Steam	7 6
Cobbles	6 3

CHEMICALS.

Messrs. S. W. Royse and Co., Albert Square,
Manchester, quote:

Acids:	£	s.	d.
Oxalic	0	0	2 $\frac{1}{2}$ per lb.
Picric, Crystals	0	0	11 "
Tartaric	0	0	10 $\frac{1}{2}$ " at Manchester

Acetate of Lime:	£	s.	d.
Brown at Manchester net	9	15	0 per ton.
Grey	12	0	0 "
Alumina: Alum, Lump, loose	5	5	0 "
" " in casks	5	7	6 "
" " Ground, in bags	5	15	0 "
Sulphate of Alumina, 14%	4	10	0 "

Ammonia: Carbonate	0	0	3 $\frac{1}{2}$ per lb.
Muriate Grey f.o.b. Liverpool	23	15	0 per ton.
Sal-ammoniac, Lump, 1sts, del ^d U.K.	42	0	0 "
" " 2nds, "	40	0	0 "
Sulphate	12	11	8 " f.o.b. Liverpool
Arsenic: Best White Powdered	12	5	0 "
Bleaching Powder, 85%	4	10	0 "
Borax: British Refined Crystal	12	0	0 "

Coal Tar Products:

Benzole, 50/90 %	0	0	6 per gal.
" " 90%	0	0	7 "
Carbolic Acid Crystals, 34/35° C.	0	0	6 $\frac{1}{2}$ per lb.
" " " 39/40° C.	0	0	6 $\frac{1}{2}$ "
" " Liquid, 97/99 %	0	0	9 per gal.
" " Crude, 62 $\frac{1}{2}$ % at 60° F.	0	1	9 $\frac{1}{2}$ " f.o.b.
Creosote, ordinary good liquid	0	0	1 $\frac{1}{2}$ "
Naphtha, Crude, 20 % at 120° C.	0	0	8 "
" " Solvent, 90% at 160° C. f.o.b.	0	0	8 "
" " " 95 % at 160° C. "	0	0	9 "
" " " 90 % at 190° C. "	0	0	10 "
" Rectified, flash point over 78° F.	0	0	11 " f.o.b.
" Rectified, flash point over 100° F.	0	1	0 " f.o.b.
Naphthalene, all qualities			
Pitch	1	7	6 per ton.
Copperas: Green, in bulk	0	12	6 "
" " barrels f.o.b. L'pool	1	19	0 "
Cake	1	2	6 "
Copper: Sulphate	19	15	0 "

Cyanides: 98% minimum f.o.b. net | 0 | 0 | 7 $\frac{1}{2}$ per lb. |

Lead: Acetate (Sugar) White, English	27	10	0 per ton.
" " " Foreign c.i.f. U.K.	23	5	0 "
" " " Grey	21	15	0 "
" " " Brown at Manchester	16	15	0 "
Nitrate	24	10	0 "
Litharge, Flake	15	10	0 "
" Powder	16	0	0 "
Red Lead, Genuine, c.i.f. London less 5%	15	10	0 "
White " " " Dry " " "	16	15	0 "

Naphtha (Wood): Miscible, 60 o.p. 0 | 2 | 10 per gal. || Solvent | 0 | 2 | 7 " |

Potash: Bichromate... delivered England	0	0	3 per lb.
Carbonate, 90/92 % ... c.i.f. Hull	18	5	0 per ton.
Caustic, 75/80 %	20	10	0 "
Chlorate	0	0	3 $\frac{1}{10}$ per lb.
Montreal	33	10	0 per ton.
Prussiate, Yellow	0	0	5 per lb.

	£	s.	d.	
Soda: Ash, Caustic, 48 %, Ordinary ... net	5	5	0	per ton.
" " " " Refined..... "	6	5	0	"
" Carbonated, 48 %..... "	5	10	0	"
" " 58 % (Ammonia Alkali).....net	4	10	0	"
" Bleachers' Refined Caustic 50/52 %.....net	6	10	0	"
Caustic, White, 77 %..... "	10	10	0	"
" " 70 %..... "	9	12	6	"
" " 80 %..... "	8	12	6	"
" Cream, 60 %..... "	8	10	0	"
Crystals, in bags..... "	3	0	0	"
" barrels..... "	3	7	6	"
Acetate.....c.i.f. Hull net	16	15	0	"
Bicarbonate, in 1 cwt. kegs.....	6	15	0	"
Bichromate.....delivered England...	0	0	2½	per lb.
Chlorate.....net	0	0	3½	per lb.
Nitrate...ex quay Liverpool, ...	11	5	0	per ton.
Phosphate.....	9	5	0	"
Prussiate.....net	0	0	3½	per lb.
Silicate, Solution, 140° Tw.....	4	10	0	per ton.
Sulphate (Glauber Salts).....	1	12	6	"
" (Saltcake, 95%).....	1	15	0	"
Sulphur: Recovered.....	4	15	0	"
Roll.....	6	15	0	"
Flowers.....	7	10	0	"
Zinc: Sulphate.....	6	15	0	"
Shellac: Standard TN orange spot.....	7	5	0	per cwt.

MINERALS.

Messrs. S. W. Royse and Co., quote:—

	£	s.	d.	
Barytes: Lump Carbonate, 90/92%.....	3	10	0	per ton.
Sulphate, No. 1, White.....	2	15	0	"
China Clay: of various qualities for all purposes; prices from about 11/- to about 30/- per ton, f.o.b. Cornwall: stocks also kept at Runcorn and Preston. Quotations given carriage paid.				
Chrome Ore: Basis 50% c.i.f. British Ports.....	3	10	0	"
Manganese: Lump c.i.f. Liverpool 10½d. per metallic unit.				
Ochre: French JC..... f.o.b. Rouen, net	2	5	0	per ton.
" " JF.....	5	10	0	"
Talc: (French Chalk).....c.i.f. Liverpool	3	10	0	"

Messrs. Henry Bath and Son, quote:—

	£	s.	d.	£	s.	d.	
Copper, Ores of, 10 to 25%	0	11	9	to	0	12	9 per unit.
Regulus, 45 to 55%	0	13	0	to	0	13	6 "
Precipitate, 65 to 80% ...	0	13	1½	to	0	13	7½ "
Tin Ores, 70 %.....	85	0	0	to	87	0	0 per ton.
Lead Ore, 70%.....		6	13	0			"
Blende, 50%.....		6	8				"
Calamine.....		6	11				"
Antimony Ore, 50%.....	12	0	0	to	15	0	0 "

Messrs. Barrington and Holt, Cartagena, quote:—

Iron Ore.

	s.	d.	
Ord. 50%, ...f.o.b. Porman	6	3	per ton.
Do. " Cartagena.....	6	6	"
Special low phos. " Porman.....	6	10	"
Do. " Cartagena.....	7	0	"
Extra quality do. "	7	6	"
Special Iron Ore			nominal
Specular 58% do. "	9	6	"

TIMBER.

Messrs. Alfred Dobell and Co., Liverpool, quote:—

COLONIAL WOODS.

Timber.

	£	s.	d.	£	s.	d.
Quebec Square White Pine... per cub. ft.	0	1	9	to	0	3
Quebec Waney Board Pine...	"	0	2	8	0	3
St. John Pine, 18 in. average ..	"	0	2	4	0	3
Lower Ports Pine.....	"	0	1	3	0	1
Quebec Red Pine.....	"	0	1	6	0	2
Quebec Oak, 1st quality	"	0	2	9	0	3
Quebec Oak, 2nd quality ...	"	0	1	6	0	2
Ash	"	0	1	6	0	2
Elm	"	0	3	3	0	4
Hickory.....	"	0	2	0	0	2
Quebec Birch	"	0	1	6	0	2
St. John Birch	"	0	1	6	0	2
Birch Planks.....	"	0	0	9	0	0
Spruce Spars	"	0	0	10	0	1

Deals.

1st quality Quebec Pine	per std.	22	10	0	to	32	10	0
2nd do.	"	17	0	0		22	0	0
3rd do.	"	11	10	0		13	0	0
St. John, N.B., etc., Spruce	"	7	10	0		7	15	0
Nova Scotia Spruce.....	"	7	0	0		7	10	0

Spruce Boards..... 6 7 6 6 12 6

UNITED STATES, etc., WOODS.

Pitch Pine.

	£	s.	d.	£	s.	d.
Hewn..... per cub. ft.	0	1	4	to	0	1
Sawn	"	0	1	0	0	1
Planks, Stowage	"	0	0	10	0	1
Boards, Prime	per std.	12	10	0	16	0

Oak Timber

Oak Planks

East India Teak..... per load 12 0 0 16 0 0

Greenheart..... 6 15 0 7 10 0

EUROPEAN WOODS.

Timber.

	£	s.	d.	£	s.	d.
Riga Redwood	per cub. ft.	0	1	6	to	0
Dantzic and Memel Fir, Crown	"	0	2	1	0	2
Dantzic and Memel Fir, Middling	"	0	1	9	0	1
Stettin	"	0	1	9	0	1
Swedish.....	"	0	1	0	0	1
Riga Whitewood	"	0	1	0	0	1
Norway Mining Timber	"	0	0	9	0	1
Dantzic and Stettin, etc., Oak.....	"	0	2	6	0	3

Norway Spars..... 0 1 2 0 1 9

Deals.

Red Archangel and Onega, 1st quality	per std	19	0	0	20	0	0
Red Archangel and Onega, 2nd quality	"	14	0	0	16	0	0
Red Archangel and Onega, 3rd quality	"	10	10	0	12	10	0
St. Petersburg, 1st quality...	"	16	0	0	17	10	0
Do. 2nd	"	14	0	0	15	0	0
Gefle	"	11	10	0	16	0	0
Wyburg	"	11	0	0	12	10	0
Uleaborg	"	10	0	0	12	10	0
Gothenburg	"	11	0	0	16	0	0

SELECTED PATENTS.

Compiled expressly for this journal by **Messrs. Page and Rowlingson, Engineering Patent Agents, 28, New Bridge Street, London, E.C.,** and at Manchester.

Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton Buildings, Chancery Lane, W.C., at the uniform price of 8d.

NEW PATENTS APPLIED FOR.

When Patents have been communicated the names of the communicators are printed in *italics*.

3015a. T. Suzuki, London. May 29th.—Improved feeding, measuring, and stoking apparatus for furnaces. (Date applied for, Feb. 14, 1905.)

3015b. T. Suzuki, London. May 29th.—Improved furnaces fire-grate. (Date applied for, Feb. 14th, 1905.)

11156. R. Sutcliffe, Leeds. May 29th.—Improvements in or in connection with means for driving belt and band conveyors.

11158. T. Horrocks, Stretford. May 29th.—Improvements in expanding reamers for engineering and other mechanical purposes.

11189. J. Stone and Co., Ltd., and W. R. Preston, London. May 29th.—Improvements in and connected with locomotive boilers.

11211. C. Houben, London. May 29th.—Improvements in or relating to engine cylinders.

11218. Société en Participation pour l'Exploitation des Moteurs Becht, London. May 29th.—Improvements in rotary fluid pressure engines applicable also to compressors. (Date applied for, May 28th, 1904.)

11223. H. F. Dastur, London. May 29th.—Improvements in self-closing valves or push-cocks.

11240. G. R. W. McDonald, N.S.W. Australia. May 29th.—Nut-lock. (*M. McDonald, Canada.*)

11246. S. Tebbutt, Southampton. May 30th.—Improvements in split pins used in engineering for preventing nut and the like from working loose.

11253. H. R. P. Lomas and J. W. Smith, Manchester. May 30th.—Improvements in or in connection with the furnaces of steam generators and the like.

11273. T. M. Mills, T. J. McKinnon, and C. L. Bass, U.S.A. May 30th.—Improvements in nut locks.

11285. W. Fritsche, London. May 30th.—Improvements in vanes for turbine wheels.

11289. E. Queipo, London. May 30th.—Improvements in marine cylindrical boilers.

11291. W. Fairweather, London. May 30th.—Self-locking nuts. (*The Grip Nut, Co. U.S.A.*)

11319. F. W. Gordon, London. May 30th.—Improvements in fluid-actuated turbines.

11320. F. W. Gordon, London. May 30th.—Improvements in turbines, pumps and blowers.

11321. N. W. Akimoff, London. May 30th.—Improvements in transmitting devices for engines.

11340. Sir W. G. Armstrong, Whitworth and Co., Ltd., and W. G. Wilson, London. May 30th.—Improvements in balancing the moving parts of engines.

11348. W. L. R. Emmet, London. May 30th.—Improvements in governing mechanism for turbines.

11378. J. Atkinson, Stockport. May 30th.—Improvements in rotary pumps and motors.

11379. R. Sutcliffe, Leeds. May 31st.—Improvements in or in connection with belts or band conveyors.

11380. W. I. Sutcliffe, Leeds. May 31st.—An improved construction of heat non-conducting cover for the flanges of steam pipes and the like.

11405. W. Peschel, Germany. May 31st.—Improvements in endless band propellers for marine vessels.

11430. J. H. O. Bunge, London. May 31st.—Improvements in turbine engines.

11464. D. E. Hipwell, A. D. Jenkins, and W. E. Pinder, Burnham-on-Crouch. June 1st.—Improvements in rotary engines.

11477. E. Williams, Manchester. June 1st.—Improvements in steam superheaters.

11495. W. Baines, Preston. June 1st.—Improvements in the construction of tubular boilers.

11515. H. Lindblom and The Sandycroft Foundry Co., Liverpool. June 1st.—Improvements in turbines for steam and the like fluid pressure.

11570. B. E. Eldred, London. June 2nd.—Improvements in steam boilers.

11591. W. Vivian, London. June 2nd.—An improvement in lubricating fluid-pressure engine, especially applicable to those having partially rotating valves.

11629. O. Zimmermann, London. June 2nd.—Improvements relating to the formation of stacks of tubes especially applicable for water-cooling and heating apparatus and the like.

11630. C. Francis, Gloucester. June 2nd.—An improved ship's propeller.

11639. J. M. Fleming, Glasgow. June 3rd.—Improvements in ship's propellers.

11665. H. A. Mavor, Glasgow. June 3rd.—Improvements in steam generators.

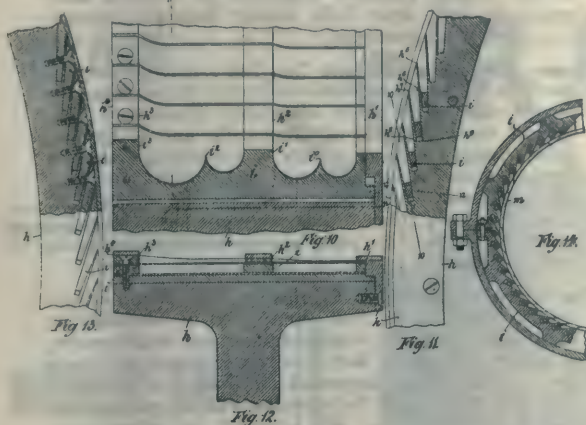
L. Wild, London. June 2nd.—Chain-belt drive for machinery and motors.

RECENT SPECIFICATIONS.

IMPROVEMENTS RELATING TO STEAM OR GAS TURBINES.

Messrs. Bellis and Morcom, Ltd., and A. Jude, Birmingham. May 4th 1905.—This invention relates to steam or gas turbines of the impact or Pelton-wheel type and has for its objects an increase in the efficiency of such turbines and increased facilities for effecting their manufacture. In turbines of this type it is difficult or impossible to so exactly adjust the receiving surfaces of the buckets of the rotor to the guiding surfaces of the stream delivered from the stator as to

entirely avoid loss by shock on entry. In the attempt to approach as nearly as possible to true tangential incidence of the stream on to the bucket surfaces, some portion of the stream is very liable to be delivered outside the receiving edge of the bucket and be spilt, energy being lost in consequence. One portion of the invention relates



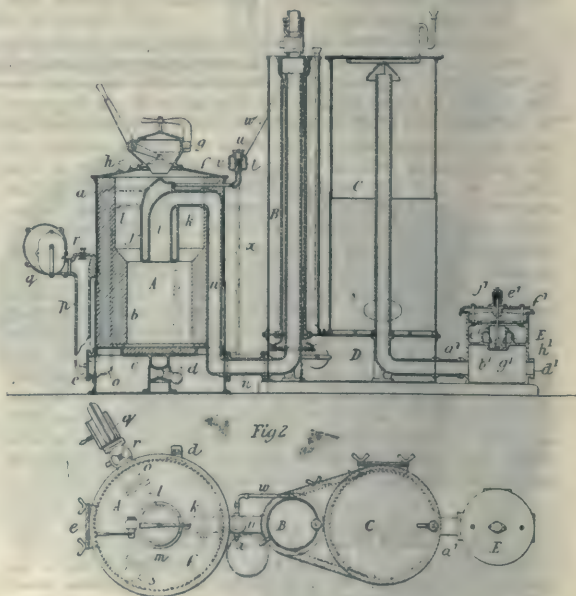
to means for minimising the loss above referred to by the provision of auxiliary buckets adapted to utilise a large proportion or the whole of the energy of that part of the stream which may be delivered outside the receiving edge of the principal buckets. By adoption of such auxiliary buckets for a subsidiary portion of the stream, it will be possible to arrange for the main portion to impinge on the surfaces of the principal buckets of the system with a more perfect angle of incidence than otherwise would be possible. The other portion of the invention relates to improvements in the structural arrangements of the parts of the rotor and stator which receive and deliver the fluid, having for their object increased efficiency and greater facility in the construction and assembly of the parts. One manner of carrying the invention into effect is to form the edge of each of the bucket pieces against which the fluid stream is directed to the required contour to provide primary and supplemental impinging surfaces. The surface of the primary is ordinarily made larger than that of the supplemental bucket as the quantity of fluid directed against the latter is usually but a small proportion of the main stream. To each of the bucket pieces a thin sheet metal plate is secured to serve as a partition between the bucket pieces when the latter are assembled. The partitions may be formed integrally with the bucket pieces by suitable milling operations. The said bucket pieces are secured in the required angular position around the periphery of the disc upon which they are carried by a pair of lateral flanges bolted to the disc. For obtaining additional security projections are provided on the sides of the bucket pieces and adapted to engage corresponding recesses formed in the adjacent disc flanges. In turbines compounded for velocity, the guide channels are constructed in a similar manner to the bucket aforesaid with the exception that each of the elements is provided with but one impinging surface.

IMPROVEMENTS IN GAS-PRODUCING PLANT.

J. Dunlop and Kynoch, Ltd., Handsworth and Witton, respectively. May 4th 1905.—This invention relates to gas generating plant in which the fuel is entirely consumed by combustion in a mixture of steam and atmospheric air in a closed generator or producer of the well-known cupola type of plant in which the mixture

of steam and atmospheric air is drawn through the generator by the vacuum produced during charging strokes of the pistons in the cylinders of the motors to which the plant supplies gas. The object of the invention is to so arrange and construct the various parts of the plant that the gas generated will be of uniform quality and at the same time ensure that the condition of the fuel in the generator will at all times be such that this uniform quality of gas will be produced however the load on the motor may vary.

The action of the plant fitted with the improvements are as follows: A fire is lighted on the hearth of the generator and air is blown into the outside pipe by the hand-driven fan, the regulating plate on the pipe being closed while the fan is operated. The air passes to the ashpit of the generator by way of the pipe, the branch and the jacket to the branch and pipe shown by dotted lines; the air thence passes through the fire and finally leaves the plant by way of the cock on top of the gas cooler. In its passage through the jacket the air mixes with steam rising from the water and passes therewith through the fire. As soon as the quantity of gas escaping from the cock on top of the cooler is suitable for operating the motor, the cock is closed and the motor put into operation. When this is done the inlet of the fan is closed and the plate is opened a definite amount so that by the action of the motor piston when making charging strokes, a quantity of air will pass the plate to produce the gas. According to the extent of the opening past the plate a greater or lesser degree of vacuum will exist in the jacket and this will cause water to be drawn into the jacket through the water regulator in greater or lesser amount as the case may be. By raising or lowering the tube the quantity of water may be regulated so that the same quantity will be drawn into the jacket by each charging stroke of the piston and it will be understood from the construction that water will only be drawn in during charging strokes; that is to say, that as soon as the level of the water in its vessel falls below the lower end



of the tube, air will enter the tube, and by this means the quantity of water entering will be regulated exactly in accordance with work to be done by motor, and consequently also the proportion of steam and air in the mixture in passing through the generator will be such as to maintain a uniform quality of gas production.

NEW PUBLICATIONS.

"MODERN ELECTRIC PRACTICE."

Volume VI. Edited by Magnus MacLean. The Gresham Publishing Company. 9s. net.

On several previous occasions we have called attention to this excellent work. The present volume comprises articles on telegraphy by A. C. Booth; telephony by D. Sinclair; electricity in mining by D. Burns; electric cranes by P. Dawson; electro-medical appliances, by D. Turner, and modern electrical appliances, employed in the operation of railways, by W. E. Langden.

"THE DESIGN OF BEAMS,

Girders and Columns in Machines and Structures, with Examples in Graphic Statics." By William H. Atherton. Charles Griffin and Co. Ltd. 6s. net.

There should be a strong demand for this concise treatise which will serve as an admirable introduction to the many intricacies associated with the study of beams. The author deals in an elementary manner with the main principles and considerations involved in designing beams and columns of such forms and materials as commonly occur in machines and structures. As far as possible abstruse mathematical problems have been avoided, but at the same time, the author has aimed at going to the root of all matters of fundamental importance. The work is illustrated with numerous diagrams, which include examples illustrative of the graphical method of estimating the stresses in the several members of braced girders. A word of commendation is due to the writer for his endeavour to present to the student a clear conception of the exact meaning of the various technical terms used throughout the volume.

"GAS ENGINE DESIGN."

By Charles Edward Lucke. Archibald Constable and Co., Ltd. 12s. 6d.

The writer informs us that the aim of this work is to present in a compact form those principles which underlie the design of gas-engines, together with such data on the subject as seem reliable for the use of those engaged in building this kind of machinery and who are familiar with its characteristics. The book is devoted entirely to the quantitative side of design and treats solely of the forces in, and the energy-transforming power of, the standard mechanism of the exploding gas-engine. Conveniently divided into three sections, the first part of the work deals with power, efficiency, and economy, and includes the material required for deciding on the necessary piston displacement for any specified output for any kind of gas. Part two comprises the data and method for determining the stresses in the parts and the number and arrangement of cylinders necessary for balance or turning effort to meet the specifications. The concluding section, is concerned with the dimensions of the parts to resist the stresses, showing by theoretic analysis and by empirical formulæ, between what limits every principal dimension should lie. The volume is well-produced and profusely illustrated.

BOOKS RECEIVED.

"The Crystallisation of Iron and Steel." An introduction to the study of metallography. By T. W. Mellor, D.Sc. Longmans, Green and Co. 5s. net.

"The Principles of Foreign Exchange as affecting the Preferential Trading with the Colonies proposed by the Right Hon. Joseph Chamberlain, M.P." By Ewing Matheson. E. and F. N. Spon. 3d.

"Steam Boilers; their History and Development." By H. H. P. Powles. Archibald Constable and Co., Ltd. 24s. net.

"Engineers' Turning in Principle and Practice." By Joseph Horner. Crosby, Lockwood and Son. 9s. net.

NEW CATALOGUES.

The Salt Lake Hardware Company, of Salt Lake City, Utah, U.S.A., forward details of their No. 14 Keller Assay Balance sensitive to 1-100th milligrammes, and their O.B. Keller Balance sensitive to 1-500th milligrammes.

Messrs. James Simpson and Co., Ltd., 101, Grosvenor-road, S.W., and Newark-on-Trent, have issued a record edition of their admirably-illustrated History of the Goldfields of Coolgardie and Kalgoorlie Water Supply Scheme. This, while calling attention to the extensive work carried out by the company is a souvenir which will doubtless be welcome in any engineer's office. Extracts are now included from the Australian press giving information as to the successful working of the scheme.

The Crypto Electrical Company, of Bermondsey-street, S.E., have just completed a circular on their alternating to continuous current transformers, a matter on which they have specialised for many years. The latest improved apparatus is described and illustrated, and the circular will be particularly useful to those who are situated on alternating-current mains and require a small supply of continuous current for charging accumulators or for small plating plants.

Messrs. Brown, Boveri and Co., Ltd., Baden, Mannheim, etc., have published a well-printed and illustrated pamphlet on their automatic overload and reverse current relay. The action of the relay, is based on Ferrari's well-known principle. A light aluminium disc is arranged to revolve between the poles of a laminated electro-magnet. The electro-magnet is energised by alternating current taken from the secondary side of a transformer, the secondary current being proportional to the main current of the machine. The necessary rotatory field to produce the torque on the disc is obtained in a very simple manner by adding a short-circuited copper ring to cover half the cross-section of the magnet. In this way one obtains two alternating fields differing in phase, these two fields giving a resultant rotating field, which sets up Foucault currents in, and induces a torque on the aluminium disc. The spindle of the disc is horizontally pivoted and carries a small drum on which a silk cord with a weight suspended at the end is wound up. At normal load and up to a pre-determined current strength, the weight prevents the disc from turning. If the working current now exceeds the pre-arranged figure, the torque on the disc increases and the cord with the weight suspended at its end is wound up on the drum. When the weight rises a certain height it closes a circuit by bringing together two very light contact springs arranged in a horizontal position. A strong permanent magnet, between whose poles the aluminium disc rotates, serves to damp the action of the disc and prolongs the time taken in lifting the weight. The contact springs are connected to the circuit of the tripping solenoid arranged on the switch. When the contacts are brought together the solenoid attracts its armature, and the main switch, due to its own weight and to the action of the springs, operates. The tripping current is about two amperes, and is generally taken from the exciters, or from a small accumulator battery. Platinum, silver or carbon is employed for the contact points.

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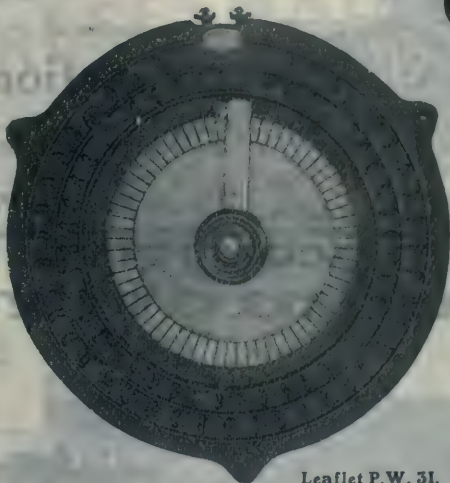
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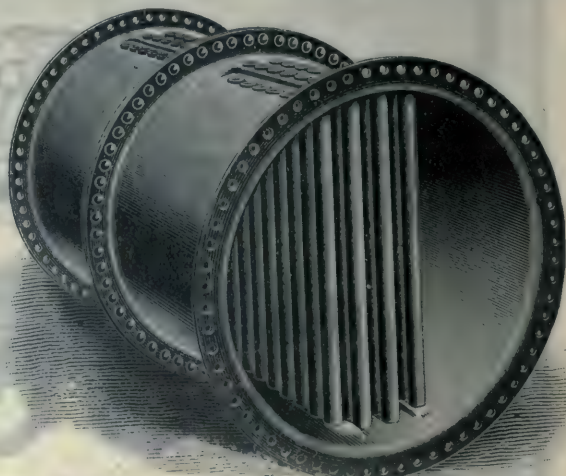
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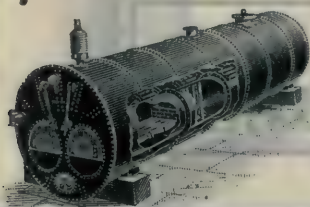
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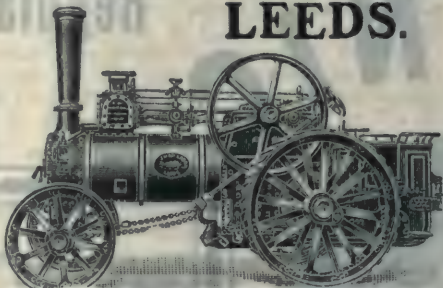
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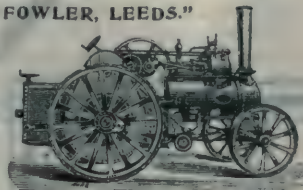
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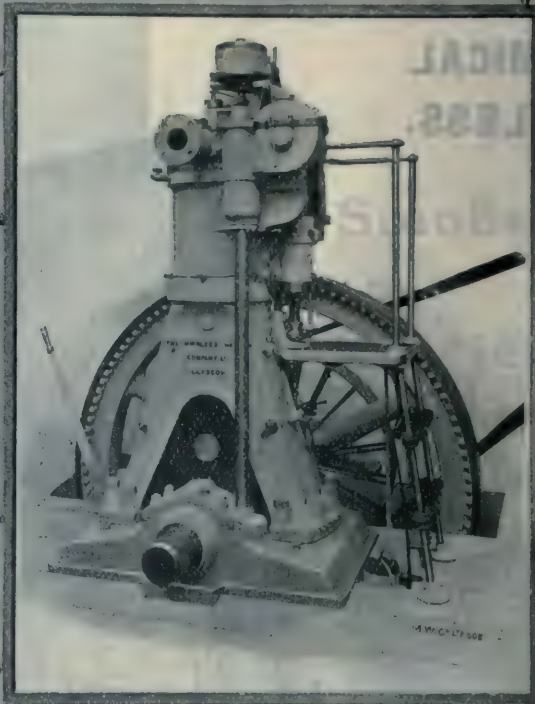
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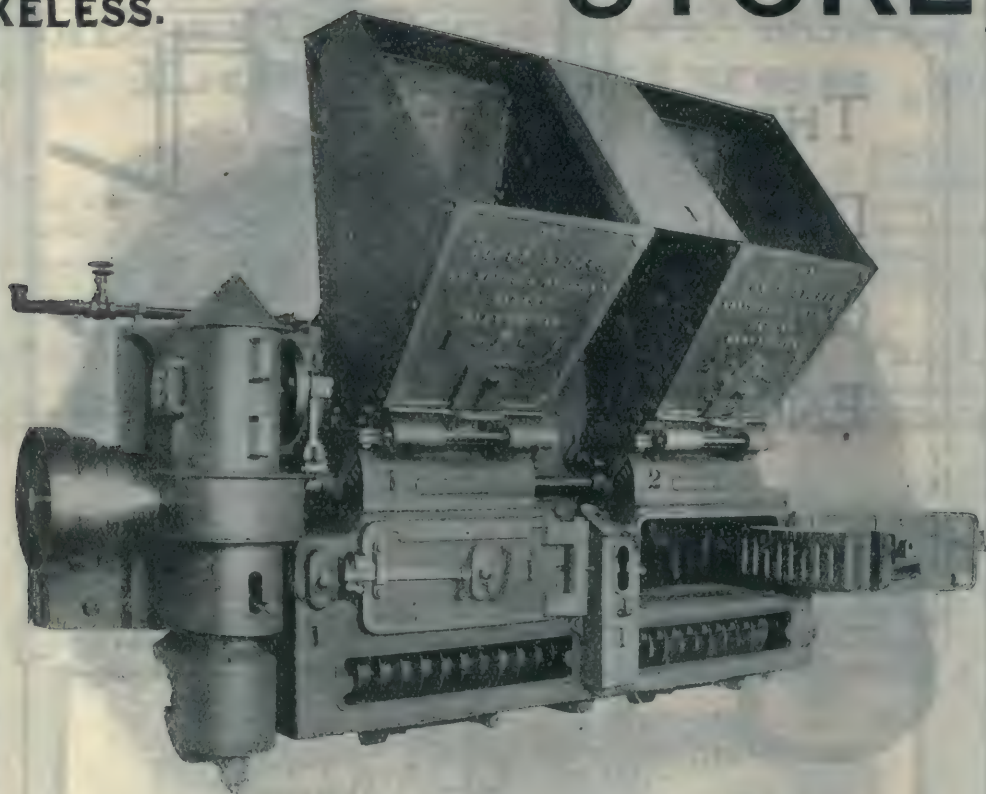


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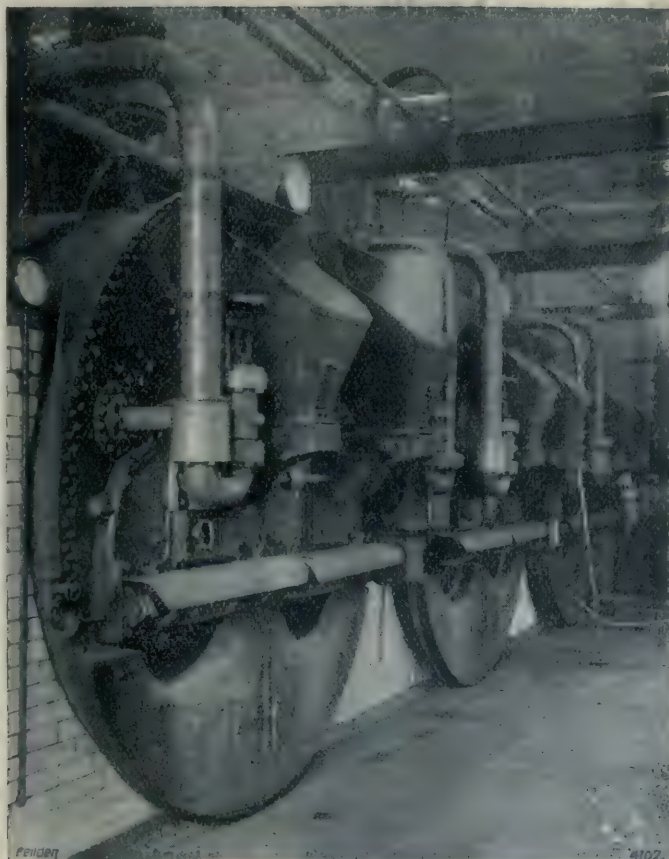
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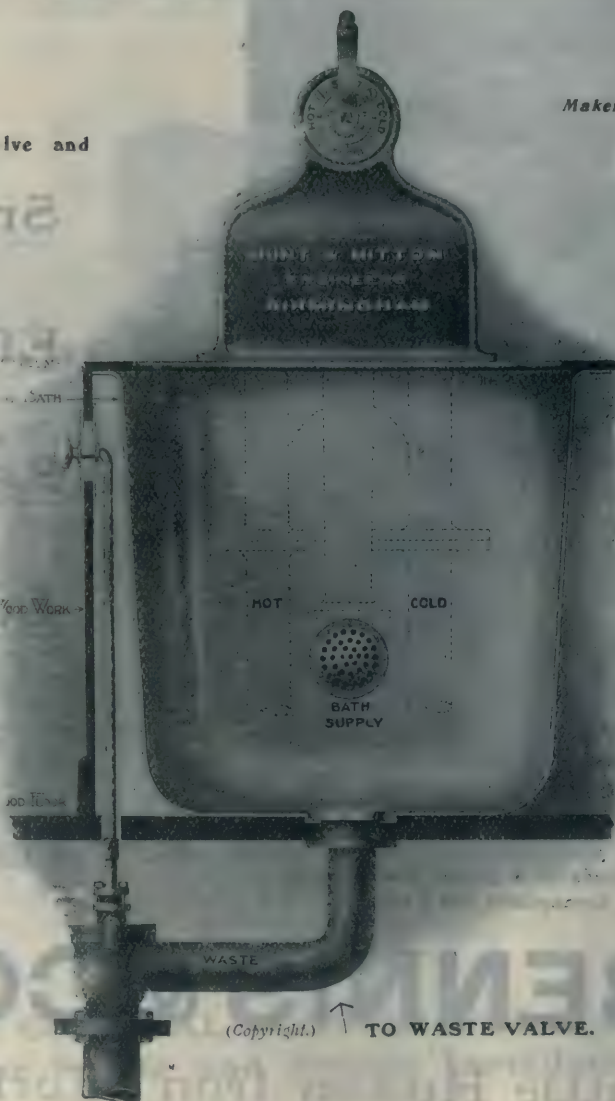
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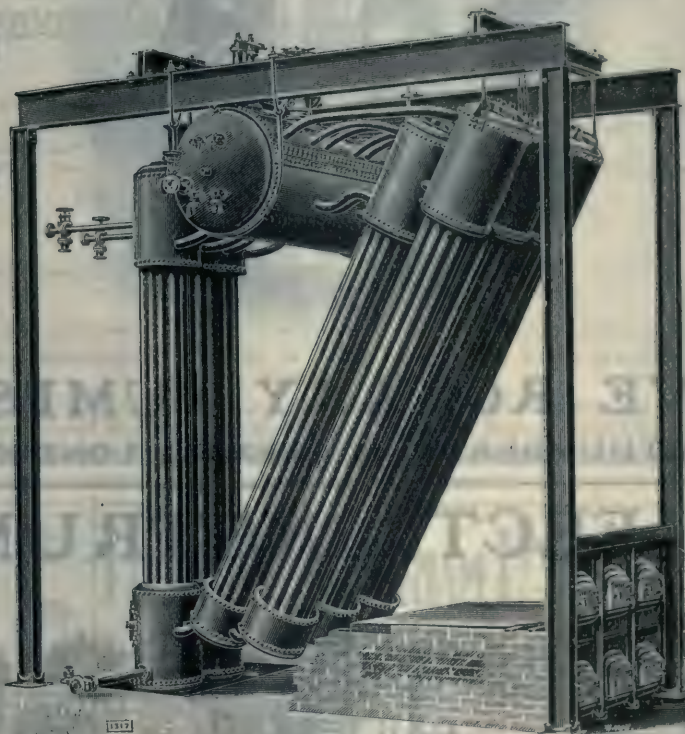
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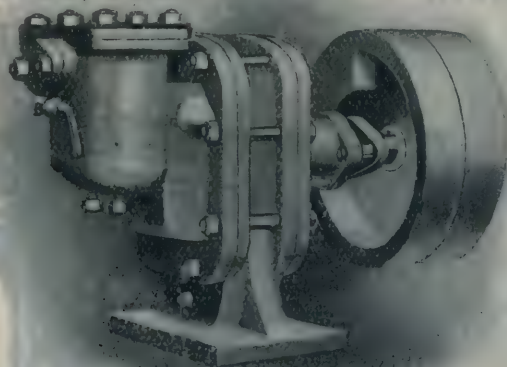
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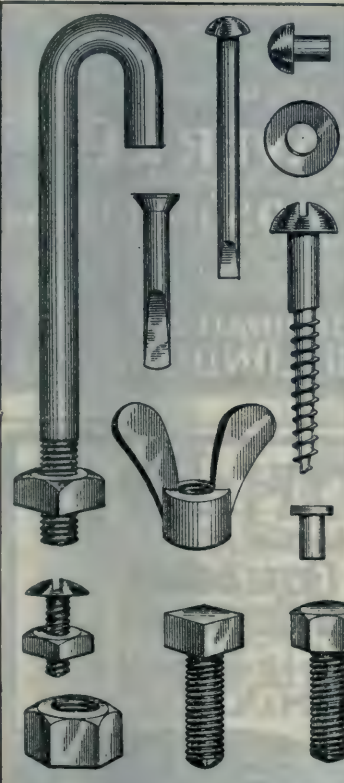
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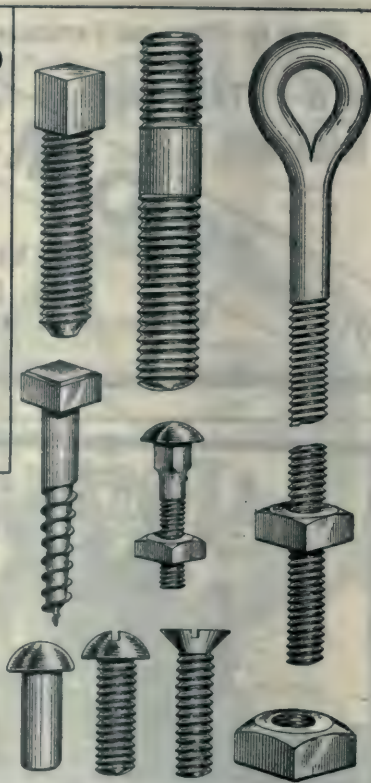
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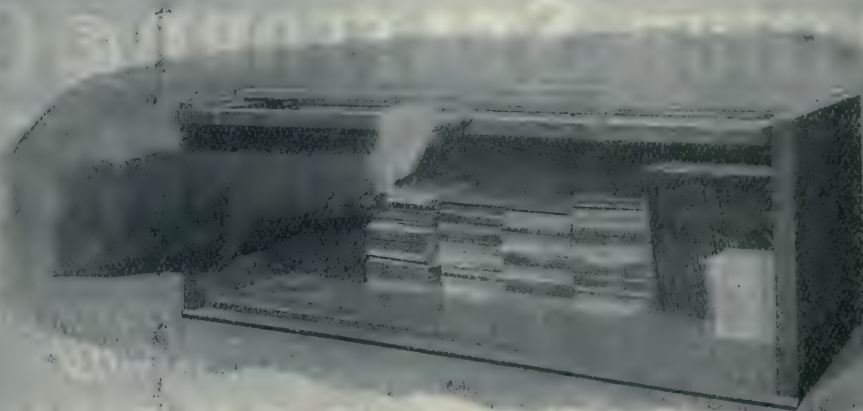
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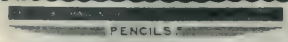
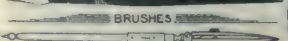
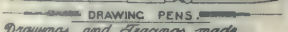
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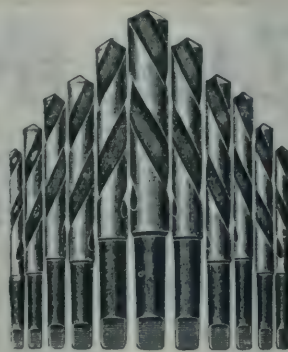
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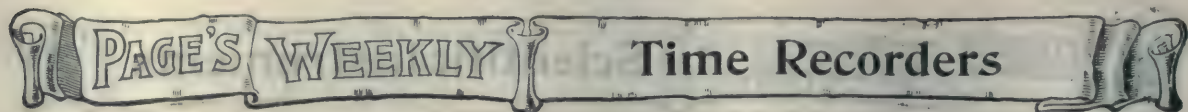
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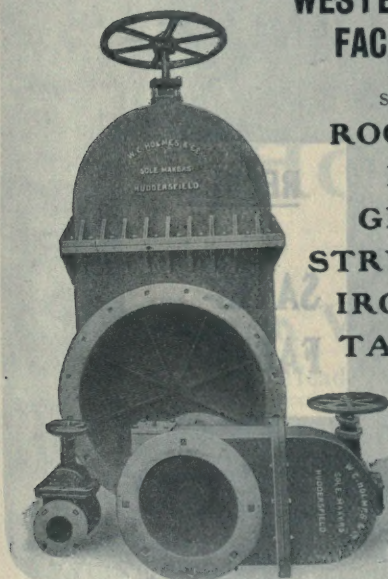
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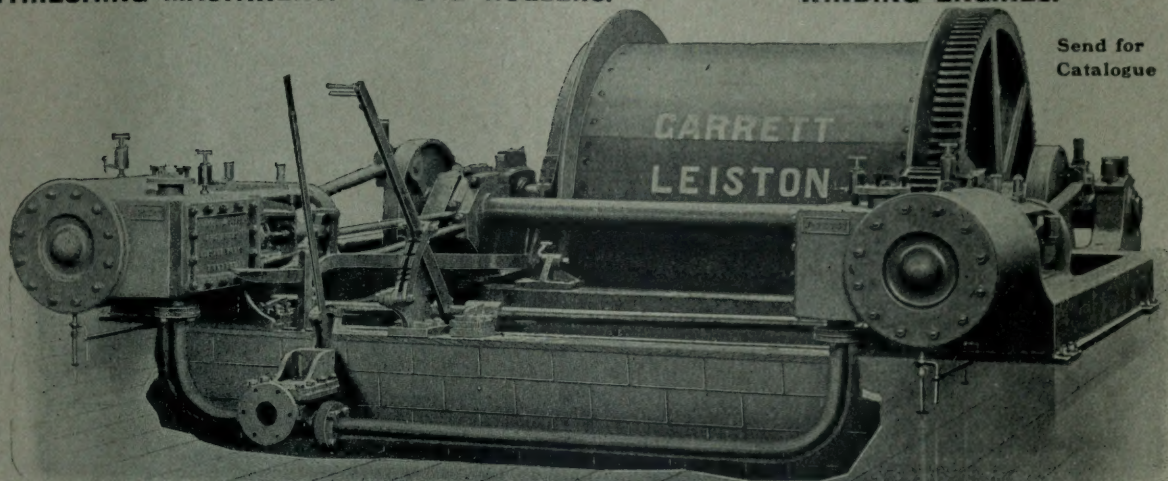
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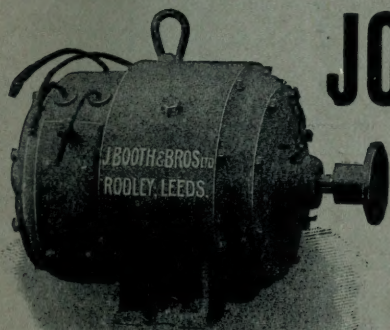
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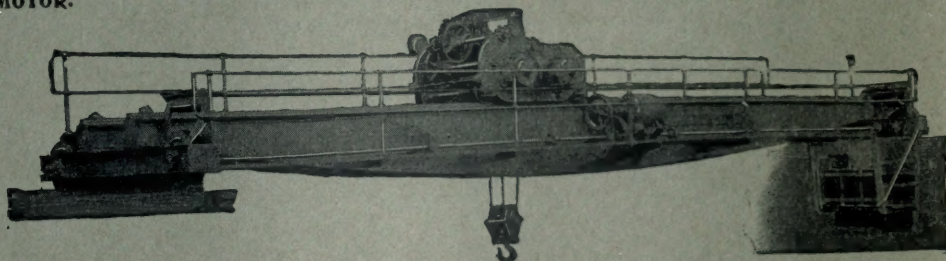
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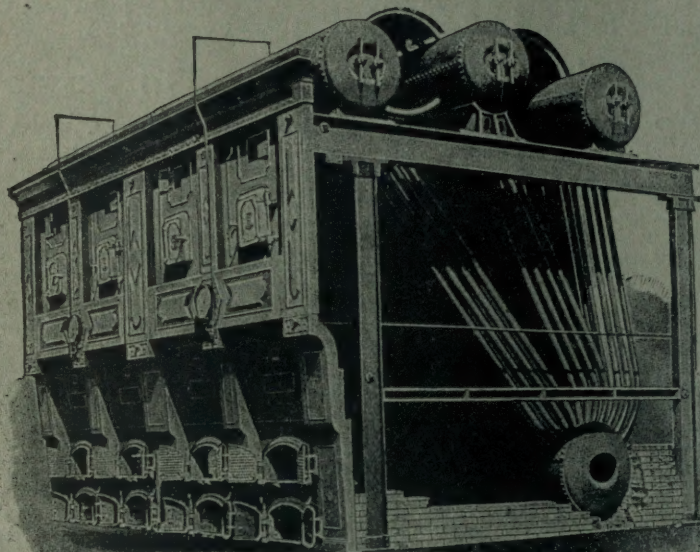
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